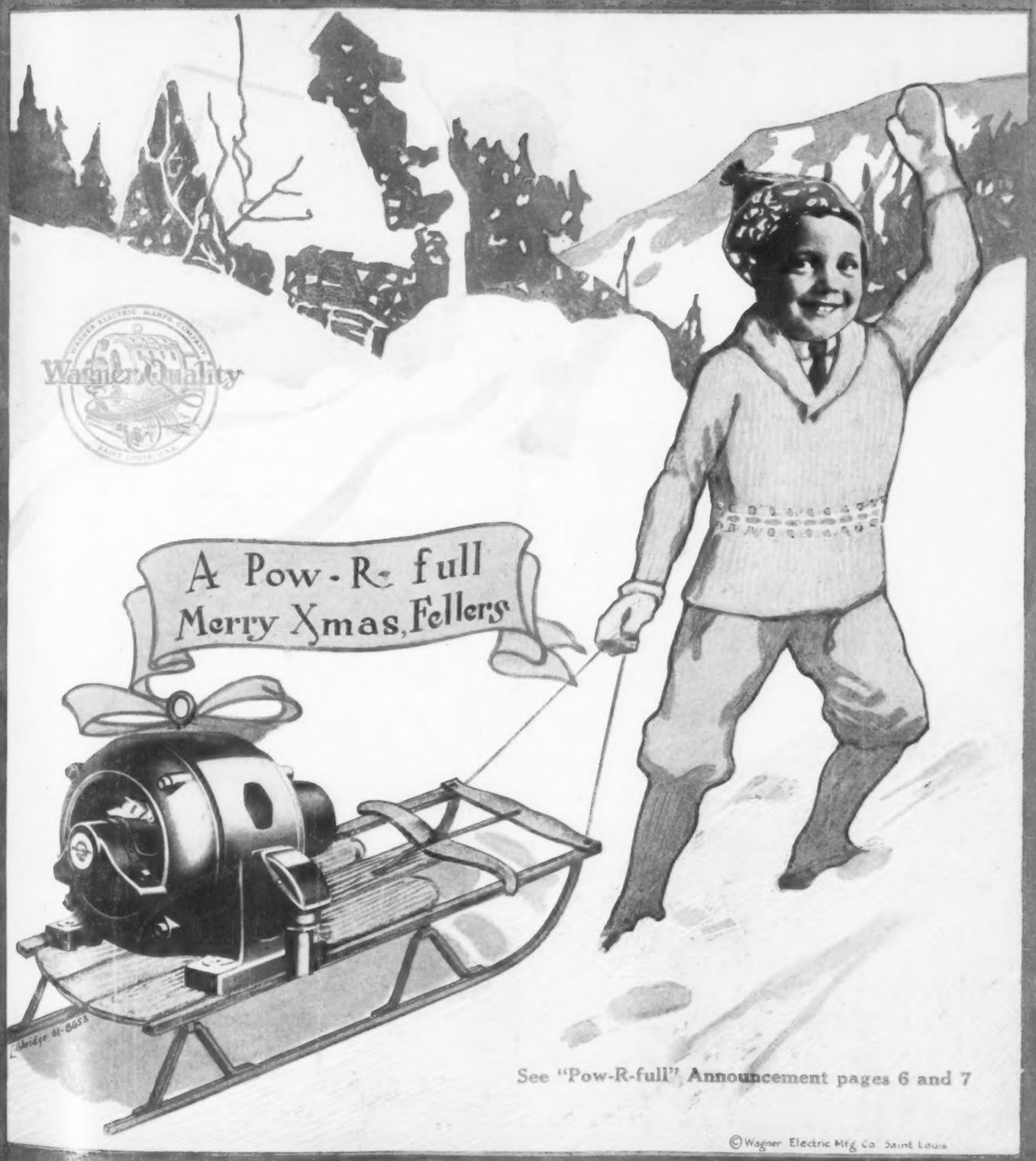
DEC 28 1921

Electrical World

McGraw-Hill Company, Inc. New York, December 24, 1921 Twenty-five Cents a Copy



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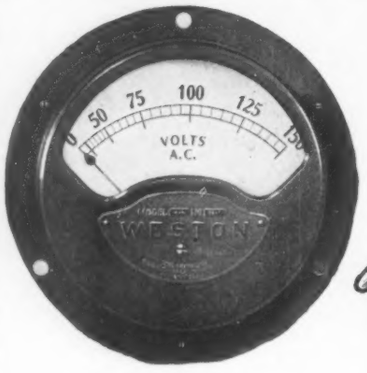

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Electrical World

New York, Saturday, December 24, 1921

A Demonstration That Points the Way

OUT of the disarmament conference is clearly coming the greatest single achievement which the world has ever seen in the cause of peace. What then? This readjustment of naval armament, this ten-year truce in world competition, means more to humanity than even this. It has brought at last a demonstration that governments possess the power to prevent as well as to cause war. And the people want still further measures of such beneficent protection.

This relief from the back-breaking burden of naval expenditures has been made possible, of course, because within our recent memory war has brought all nations close upon the brink of bankruptcy. America, it is said, will save $200,000,000 a year by this one economy. Other nations will save proportionately. And all the nations must save, because no one of the great countries in the world today is operating on a balanced budget. All are spending more than they receive. And it is a fact of tremendous import that the amount of money being spent today by European peoples on land armaments is practically the same figure by which their budgets are unbalanced.

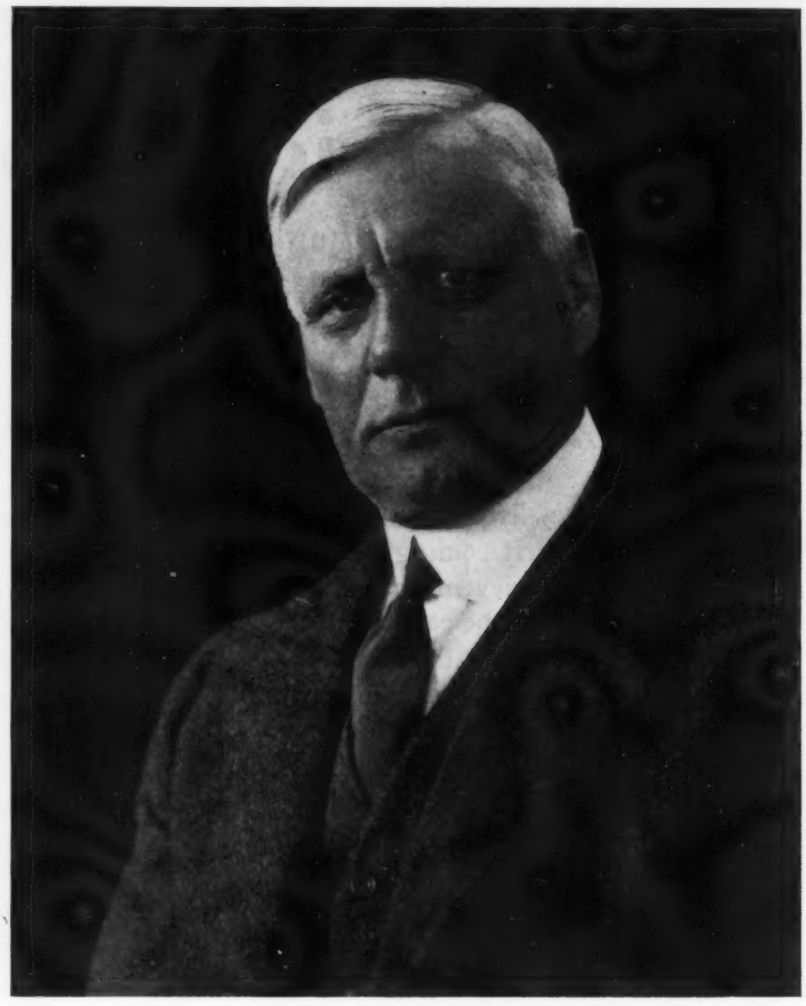
Under this economic stress, the nations of the world have met in Washington, not just to talk about their national or continental problems, but to make arrangements for the safety of all people through the prevention of more wars and the protection of the world's prosperity. They have met once and applied some common sense to naval programs. It is the first great step. And they can meet again and deal as sensibly and as effectively with armies and with other evils that affect the world.

We—the people—have seen this demonstration, and we want more of our traditional troubles settled now in this same way. For there is more than one kind of war from which we suffer. We must seek out a way to peace in our industrial warfare, no less than in international conflicts. And in the future conferences it would be well to see not alone the representatives of governments, but also men who can broadly think and speak and influence for business, finance, agriculture and labor.

Europe is slowly, surely getting back upon its feet industrially, socially and politically, but financially is almost in a state of ruin. There is but one way out—to spend less and produce more wealth. While four or five million men are still held in great armies, there is a drain upon the entire economic world. We must not stop with the fulfillment of the Washington conference. We must go on. For we have seen the way.

Cummings Coligny Chesney

Pioneer in long-distance high-tension transmission and one of the originators of the S. K. C. system, who is this year's Edison medalist.



JUST as new records are being made in long-distance high-tension transmission both commercially and in the laboratory, it is gratifying to report that C. C. Chesney, chief engineer and manager of the Pittsfield (Mass.) works of the General Electric Company, has been chosen by the American Institute of Electrical Engineers as this year's Edison medalist "for early developments in alternating-current transmission." In fact Mr. Chesney might almost be called the original long-distance high-tension transmission engineer. Prior to the experiments in the early nineties at Pittsfield of Mr. Chesney and his associates, the late William Stanley and John F. Kelly, the highest voltage in use was 2,000 and the longest transmission line was only a few miles in extent.

An experimental line was erected and Mr. Chesney at first tried out 10,000 volts, then 15,000 volts and finally 25,000 volts. The results were so successful that high line pressures and long-distance transmission were boldly advocated, this responsibility, according to a statement by Mr. Stanley a few years before his death, being taken by Messrs. Chesney and Kelly, who "always made good." More recently the Pittsfield works of the General Electric Company, which are under Mr. Chesney's supervision, have made notable progress in the development of apparatus for commercial service up to 220,000 volts, and they have just completed successful tests of 1,000,000 volts for transmission purposes.

Mr. Chesney was born in Selinsgrove, Pa., on Oct. 28, 1863. He was graduated from Pennsylvania State College in 1885. In 1888 he joined Mr. Stanley's laboratory force at Great Barrington, Mass., where he devoted himself particularly to experimental chemistry and electrodynamics. The following year he went with the United States Electric Lighting Company in Newark, N. J., a Westinghouse subsidiary. In 1890 he moved to Pittsfield, where he was one of the original incorporators of the Stanley Electric Manufacturing Company, which developed the well-known S. K. C. system (Stanley, Kelly, Chesney), the company being started with an original capital of $25,000. Mr. Chesney was vice-president and chief engineer from 1904 to 1906. On the latter date he took up the duties of chief engineer and manager of the Pittsfield works of the General Electric Company, which company had acquired the Stanley Electric Manufacturing Company.

The Stanley Electric Manufacturing Company was organized in 1890 to develop the patents of Stanley, Kelly and Chesney in the alternating-current field. The company's work was primarily of a pioneer character with little and in many cases no past experience or practices to guide it. As chief engineer it was Mr. Chesney's work not only to supervise personally the calculations and design of its equipment but also to make practical the ideas of his associates. This company built the first revolving-field types of alternators used in America. They were extensively used in hydraulic stations, notable among which were the Bay Counties and Standard companies' lines in California, at that time the longest high-voltage lines in the world, using 40,000 to 60,000 volts.

The first polyphase transmission plant equipped with the S. K. C. system to be put into successful operation and the first in America was installed in 1893 and is supplying power and light today for use in the towns of Housatonic and Great Barrington, Mass. In 1895 a 12,000-volt plant was installed for service between Lowell and Grand Rapids, Mich. The operating success of these alternators was due to a special design in which the high-tension currents were generated in the stator element by the revolving rotor, these being the first alternators to produce a true sine wave. As early as 1896 alternating-current generators of 6,000 volts with control equipment were put into successful operation on the transmission line of the Montmorency Electric Power Company, Quebec. In 1898 generators up to 12,000 volts were placed in service. During the early period two-phase alternating-current induction motors, electrostatic condensers at 500 volts and electric transformers of 100-light capacity were developed. In developing the transformer all spaces in the coils were filled with "Gilsenite" to provide better heat dissipation and insulation. This occurred as early as 1892, as did the development of cloth treated with oxidized linseed oil. In 1893 belt-driven alternators were put into successful operation, and in 1899 alternators of this design directly connected to steam engines went into use in the power house of the Staten Island Electric Company. These were the first alternators to be operated in parallel and in regular commercial service.

Mr. Chesney has always been a tireless worker, keeping in close contact with all phases of his organization and taking an active part in the civic work as well as association work. He is a fellow of the A. I. E. E., of which he was a manager from 1905 to 1908 and vice-president from 1908 to 1910. Presentation of the medal will take place at a session of the midwinter convention of the Institute, Feb. 15-17.

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician
Published by McGraw-Hill Company, Inc.

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Volume 78 New York, Saturday, December 24, 1921 *Number* 26

Customer Ownership and the News

CUSTOMER ownership of utility securities demands a new mental attitude on the part of the utility executive in his relations with the press. The day is past when the central-station-company manager can refuse to have anything to do with the newspapers. The idea that news given out should be good propaganda for the company must be abandoned. For the people are beginning to realize that they not only regulate, but own, the public service companies and therefore have a right to know what is going on.

It was fear of the radical politician that put a muzzle on the employees of railroads and other utilities and built up the negative policy of telling nothing. A positive policy of telling all would have disarmed the agitator and won the confidence and sympathy of the people, because straightforward, open honesty has a winning appeal. With public ownership through popular investment in the company the fear of political persecution dies. The people maintain the institution of the press so that they may know the news. It is the simple duty of executives to give the press full, frank and free access and tell it everything.

The people want to know about the public service company and all it does. Who is the official of the electric light and power company that he should hide things —good or bad—from those who own his corporation and, in fact, employ him? There are some men who do not yet see this thing clearly.

Ear Corn Used as Fuel in Middle Western States

SINCE the selling price of ear corn is less than one-third of a cent per pound in the corn-producing states, while coal costs twice that amount, several central-station companies are burning corn instead of coal under boilers, and the Board of Supervisors of Pocahontas, Iowa, has ordered the buying of ear corn for fuel to heat the court house and county home. This is striking evidence of the working of the economic law which halts the flow of raw materials to factories of production, and the corresponding demand for manufactured products in exchange, when the spread between the selling price of the raw material and the cost of the finished product becomes too great. The situation in Iowa is blamed upon propagandists who, it is claimed, have urged the farmers to increase production until surplus farm products are selling for about one-third the cost of production. Whether or not this is the cause, it is perfectly plain that more attention than ever before must be given to the economic needs of all industries and the production program adjusted thereto on the basis of actual requirements. The law of supply and demand is fundamental in the production of farm materials, and their conversion into beef on the hoof is in no sense different from the conversion of iron and copper into motors or other products of industry. This fundamental law of supply and demand that economists have laid down as the great leveler of prices seems to be a difficult one for most of us to comprehend and apply. In these days of falling prices it is a good subject for intensive study.

Five Hundred Cases of Undervaluation Monthly

LAST year at the custom house in New York City alone there were 5,400 cases of undervaluation of importations. This year they have been running at the rate of 500 cases every month, or about twenty a day. Why do foreigners who export to this country or American people who import from foreign countries undervalue? Because they pay less duty. Because they make more profit if they can enter a dollar of value at fifty cents. The Fordney tariff bill, therefore, proposes the American valuation plan, which will assess all ad valorem dutiable goods on the basis of the domestic value, which we can ascertain, instead of a foreign value for which we have to accept some stranger's word. It is just plain common sense.

And it must not be thought that this is a new and untried theory. Some of our greatest public men for many years, including Henry Clay, have labored earnestly to bring about this needed change. The British colonies compare the value at the source and in their own market and assess for import on the higher value. Great Britain herself at present, under the "safeguarding of British industry act," places a special additional duty of 33⅓ per cent on any foreign importation that threatens a home industry. It is the value in the British home market that governs every case that comes up.

If the electrical industry is to be saved from the blighting competition of the cheap Japanese and German goods now being sold here at prices less than our factory costs, we must have a protective tariff. And it must be made secure by the American valuation plan, so that the duty will be alike on like goods no matter whence they are imported.

Good Will as Important as Good Service

SERVICE like charity may cover a multitude of sins, but the covering may be too narrow at times for a public utility to wrap itself in. Good service without good will hardly suffices, and the company which gives the former and does not enjoy the latter is not to be envied. It may be likened to a house built upon the sand, for the spirit shown in the conference of mayors of New York State held this week indicates that its ultimate doom is merely a question of time. When the

public becomes vindictive the finest service in the world avails nothing. The Toronto Railway Company carried passengers for a nickel and less and paid the city in taxes and other emoluments $1,600,000 a year. The city took over the lines, thereby sacrificing this yearly income of $1,600,000, and immediately increased the fare to 7 cents without improving the service. This is certainly piling Pelion on Ossa and the sad part is that the people rejoice to have it so. Therefore, while we are perfecting our service, let us also cultivate good will.

The Bearing of Automatic Operation on Power Development

THERE are many streams in the United States which do not present available head enough at any one site to rise to much importance as sources of power, although the aggregate head which can be rendered available by a series of co-operating stations may be considerable. If one attempts to utilize powers of such sort in the ordinary conventional way, he is driven in an attempt to unify the system, either to very extended and costly hydraulic works or to several stations each requiring about the same operating staff that would be needed for a single station utilizing the full power of the stream.

Just at this point is where the automatic station can be utilized to the best economic advantage. One has only to develop a single site for an ordinary plant with provision for the generation of power above or below on the stream as convenience may dictate. He can then set up very simple, easily controlled and efficient little plants, which can be thrown into operation as required in the judgment of the local dispatcher quite as readily as if it had been necessary to call for help over the telephone. Whether the generators should be synchronous or asynchronous is a detail of the general design which has no particular relation to the practical situation. The point is that in any case a simple plant, used in co-operation with one directly under the control of the load dispatcher, can be thrown into or out of operation with the utmost ease and can, moreover, be provided with virtually the same automatic safety appliances that would be used in a manually operated station. Just how the requisite sequence of operations can be most easily controlled is a matter to be dictated by the actual conditions under which the plant is to operate.

The number of instances in which the general policy of automatic auxiliary stations can be carried out will prove to be surprisingly great, and it is not easy to set a limit to their usefulness. As to reliability, the plants thus far installed have shown a good record, and there is no reason why this should not be continued since the work to be done is of a very simple character and the safety precautions involve nothing unusual. There is no reason why much larger plants than the one which we have just described should not be organized in a similar manner. The control system, so long as only a single unit is installed, is substantially the same whether it is used for a hundred kilowatts or for several thousand. If the station capacity exceeds that which can be worked in this simple way, the conditions may very often make it cheaper to have an attendant than considerably to increase the complication of the automatic gear. An operator working on a single shift and being on hand merely at times when quick changes in the operation of several units might become necessary would often suffice.

Administrative Engineering, Human Relations and the Technical Schools

A RECENT article in the *Sibley Journal of Engineering* by Dean Kimball of the College of Engineering, Cornell University, which asks what the universities and technical schools are doing and can do to train their undergraduates in industrial relations deals with a subject fully worthy of the thoughful consideration the author accords it. By the very necessities of the case, the Cornell educator avers, the engineer, originally only the technical adviser of industry, has been gradually drawn over into the administrative field. Today great industries of every kind are demanding technically trained men to fill executive posts and control the human forces from whose efforts production springs. Such men the technical schools are asked to furnish in increasing numbers, and from such men it is fondly hoped will come a final solution of the problem of human relations in industry which so many self-confident administrators have attacked in vain and because of which so many promising enterprises have suffered disaster.

It is, as Dean Kimball implies, rather by the successful nurture of the engineering mind that victory in this field can be won than by the inclusion in the undergraduate curriculum of elaborate studies of administration or by protracted excursions into the field of social science and similar domains. The time at the faculty's disposal is all too scant for proper grounding in the rudiments of technology and their practical application. To attempt to train certain students for the end desired by narrow specialization in studies of the type to which allusion has been made at the expense of fundamental engineering knowledge would not produce administrative engineers, for if these executives of a new type are to be clearly distinguishable from other types, their administrative ability must be derived from, and not merely tinctured by, engineering training. Moreover, are there not grave objections to placing pseudo-scientific studies of any kind on an equal basis with those founded on the unshakable verities of mathematics? There is great reason to hope that industrial administrative and labor problems will shrink in magnitude when approached by minds in which natural ability to lead, engineering talent and broad human sympathies mingle; but here as elsewhere individual experience will prove the most important teacher. To approach these problems equipped mainly with half-digested theories incapable of scientific proof would only bring discredit on the graduate in "human relations." It is easy to step from empiricism to charlatanry, and to charlatanry engineering must ever remain the implacable foe.

Reduce the Number of Insulating Oils

NEARLY a dozen insulating oils for use with transformers, oil switches, lightning arresters and other apparatus are now on the market. In the opinion of operating engineers the number is far too great. The handling of such oils is at best a difficult matter, and when, owing to the special requirements of the different manufacturers, it becomes necessary, in order to be protected under the guarantees, to have on hand and use several different grades or makes of oil the trouble grows. Operating engineers do not assert that the same grade of oil will be found suitable for both water-

cooled transformers and heavy-duty oil switches, but they do feel that if a certain oil is suited to the oil switches of one manufacturer it should in all reasonableness be equally suited to the oil switches of another. A similar reasoning applies in the case of transformer oil. Therefore an agreement by which the total number of insulating oils would be reduced to two, or at most three, would be heartily welcomed by purchasers generally. There seems, indeed, no inherent reason why the advantages of standardization should be unattainable in this particular.

A Well-Planned Industrial Distribution System

FLEXIBILITY and safety are combined to an unusual degree in the wiring of the Pacific Coast industrial plant described by I. A. Oliver in the issue of Dec. 17. Comprehensive provision for future growth, convenience of service and safe construction are attained without losing sight of economical investment in equipment. The case cited is typical of plants whose growth is so rapid that almost continual relocation of motors is essential. Changes had to be made with minimum interruption to production, and an inflexible and far from modern installation was here transformed into a thoroughly improved layout. Fifty-eight motors with a total connected load of 600 hp., distributed throughout a plant covering four acres, presented an interesting problem in wiring and control for best results, and the flexibility attained is creditable to those in charge of the work.

The provision of switchboards with "dead" fronts and backs and the extensive use of safety switches are noteworthy features of this installation. Concentration of these switches in groups at various centers of distribution illustrates a subdivision of control which facilitates economical departmental service and which might well be followed in many plants at present depending upon one centralized assembly of switch equipment. The use of laminated flat, bare busbars in a protected compartment with the copper cross-section tapered in proportion to the electrical loading illustrates careful attention to the investment. Symmetrical location of switching and control apparatus conduces toward economy of outlay, and in this plant irregular and haphazard applications of control equipment were not permitted. It is of interest to find here a dry safety switch of unusually high rating for instantaneous control of the entire power service, showing that the designers of the plant did not make a fetish of switch segregation, but applied the same standards of construction at the entrance of power to the plant as in the remote subdivisions of control.

Other features marking the installation's advance over ordinary practice are the attention given to the spacing of conductors to avoid disturbing magnetic circuits, eddy currents and accidental contacts; the general use of overload relays and undervoltage releases on motor starters, the complete marking of control apparatus, the use of pipe framing to reduce mechanical costs, the provision of special terminal boxes to fit each type of motor, and the use of considerable old equipment which was made safe for further service without undue expense. Work of this kind is of wide suggestiveness and deserves the consideration of plant engineers responsible for revamping installations to meet the heavy duties of the future.

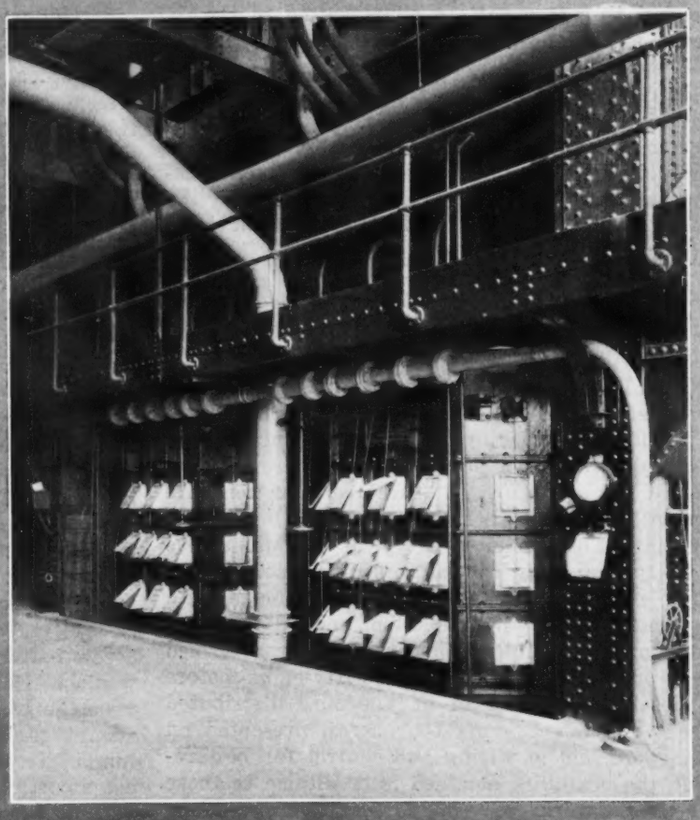
Carbon Electrode Has Undergone Astounding Evolution

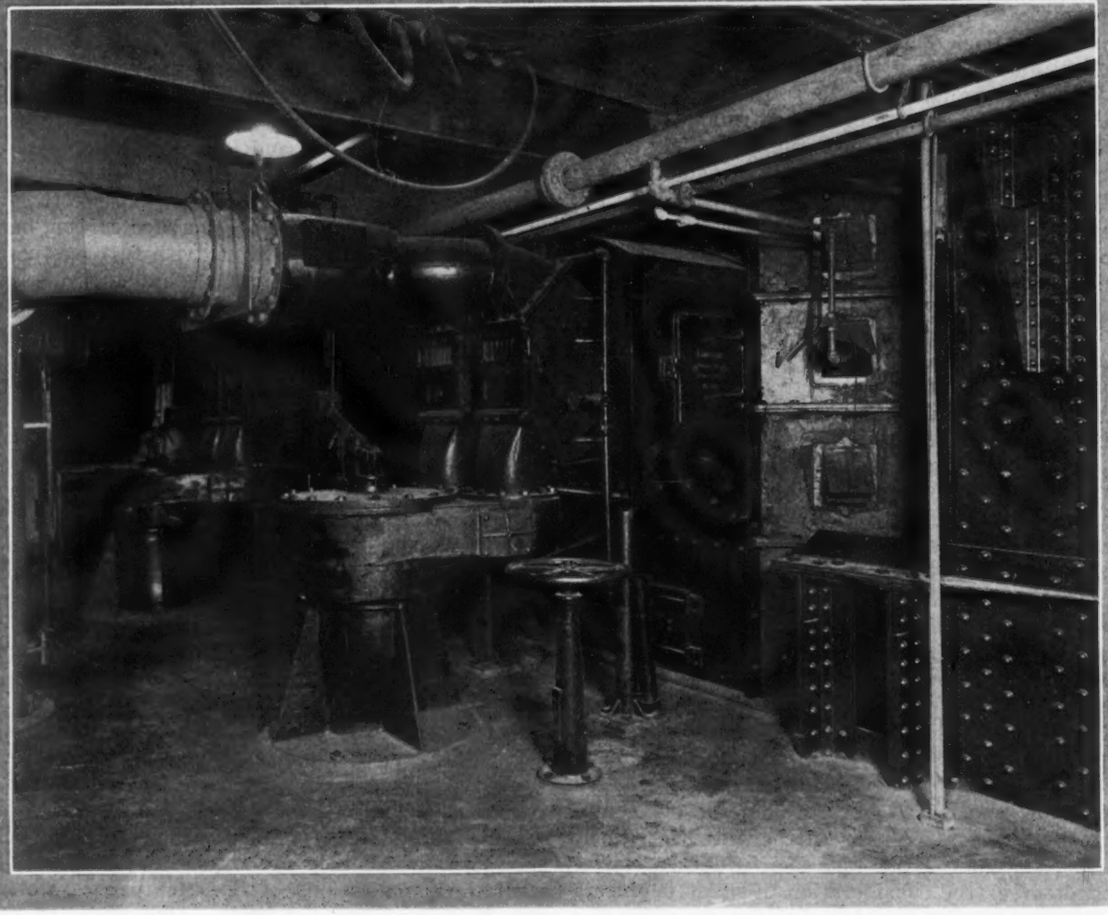
SELDOM have we published a more interesting bit of technical history than that furnished by A. T. Hinckley of the National Carbon Company regarding the development of electric furnace electrodes. It is hard to realize how soon after the beginnings of the voltaic cell the heating power of the arc was brought into play for chemical purposes and the electric furnace had its origin. Sir Humphry Davy struck the first electric arc in the year 1800. Eight years later in the first electric furnace he produced potassium carbide, and in 1815 the first electric steel was made by a process which now seems curiously and unnecessarily troublesome, but which was the beginning of the great art. It was not until more than a quarter of a century later that the electric furnace had a real beginning in the hands of Hare and Despretz. This was in that singular period of electrical evolution when, with nothing besides batteries as a source of current, the ingenuity of inventors seems to have been unlimited in forecasting the engineering work done half a century later. Many an inventor working soon after the invention of the dynamo stubbed his toe on the patents taken out by the skillful and patient men who had nothing better than a few battery cells as a source of their energy. So it was that Despretz, trying various forms of carbon, fell upon the gas retort species and not only appreciated its advantages but discovered some of the troubles later found. It was still in this battery period that the first patent on a fabricated carbon was granted in 1858.

It was not until the dynamo had become somewhat familiar in the Graumme and Siemens machines, making electric light a possibility, that Carré settled seriously to the manufacture of carbons, followed very quickly by our own Charles F. Brush, who molded his carbons from petroleum coke. The art owes not a little to Brush's persistence and ingenuity, and these simple pressed carbons such as were used for electric lights did sterling service in the beginning of electric furnace work. A little later came the squirted carbon, but when the call came for serious work with furnaces, as in the aluminum process and similar metallurgical processes, big electrodes had to be made. It was less than a quarter of a century ago, however, that the squirted carbons were brought up to a diameter of as much as three inches. Later came the heavy furnaces requiring huge electrodes capable of standing enormous changes of temperature. The squirting process broke down, and the tamping process, with the carbon mixture driven by hand or mechanical rammers into molds from which the formed electrode was subsequently removed and baked, took its place. Finally recourse was again had to retort carbon and to high grades of anthracite as the best material for the carbon mix. As the art of blending materials developed so did the process of making the electrodes, until more than ten years ago squirted electrodes up to sixteen inches in diameter and one-half ton in weight were produced with good results. From that time on, and especially through the war, the evolution of the electrode has proceeded with astounding rapidity. The weight just mentioned has been more than doubled, and these big electrodes stand up with astonishing success against the terrific temperature strains to which they are exposed. They have grown with the ramifications of electric furnace work until now it is hard to set a limit to the evolution of electrodes.

Furnaces of Ford Plant Burn Gaseous, Liquid or Powdered Fuel

FOUR remarkably large (2,640 nominal hp.) boilers equipped to burn blast-furnace gas, coal tar and powdered coal simultaneously or separately have been in operation for several months at the River Rouge plant of the Ford Motor Company. The installation shows in a striking manner the flexibility possible with powdered-fuel firing. Blast-furnace gas is used as the basic fuel, but the fluctuations of supply make it necessary to make up for deficiencies with powdered fuel and occasionally tar. Not only does the powdered-fuel equipment have to meet this requirement but it must work at odd times on fuels ranging from 100 per cent West Virginia bituminous coal down to 100 per cent coke breeze. Sometimes the latter contains as much as 14 per cent moisture. No trouble has been experienced in burning even this very wet coal, according to the Combustion Engineering Corporation, although it is to be expected that the efficiency probably decreases considerably with this extreme moisture.





Electric Furnace Electrode Has Undergone Marked Development

A Review of the Uses of Carbon Electrodes, from Sir Humphry Davy's Production of the Electric Arc in 1800 to Present Day Applications in the Electric Furnace and the Important Steps in Electrode Production

By A. T. HINCKLEY
Engineer National Carbon Company, Inc.

DEVELOPMENT of the electric furnace and its major accessory, the electrode, have progressed simultaneously since early in the nineteenth century. Without the electric furnace the large electrode would never have been called into being, and without the large electrode the mammoth electric furnace of today could not operate. No one who has followed the development of high-temperature chemistry thus far in the twentieth century can fail to realize that it has an important place in the foundation upon which our industrial fabric rests and that the electric furnace has made commercial high-temperature chemistry possible.

USES OF CARBON ELECTRODES 120 YEARS AGO

Carbon electrodes have been used as conductors for the electric current since the time of its discovery. Volta had no sooner discovered the electric battery and thus produced the first continuous flow of electrical energy than Sir Humphry Davy in 1800 used the battery with carbon electrodes attached to each pole to produce an electric arc. This invention constituted the nucleus of the electric furnace, and subsequent work has been principally enlargement and adaptation. Large steam and water-driven generators with their switches and transformers have been substituted for the Volta battery, refractory walls have been built around the electrode tips to conserve the heat, the energy developed within such walls has been multiplied a millionfold, and the electrodes have grown from tiny points of carbon to great masses weighing many tons.

These developments have stretched out over a period of 120 years. At first the progress was very slow. The energy that the Volta battery was capable of delivering was small, and the methods by which the heat, which Sir Humphry Davy's arc furnished, could be controlled so as to produce chemical change in matter adjacent to it had to be worked out. In spite of these handicaps a considerable number of electric furnace products were discovered within a few years. Probably the first substance to be produced in the electric furnace was the carbide of potassium made by Sir Humphry Davy in 1808. Electric steel was made in 1815, when W. H. Pepys made an electric resistance furnace out of a slotted iron wire and, heating this by current from a bank of batteries, caused it to absorb carbon from diamond dust and become steel. Important electric furnace products—viz., graphite, calcium and phosphorus—were made by Robert Hare in 1839, but only in tiny amounts, just sufficient for identification. Many forms of furnaces were proposed and some, such as the charcoal tube furnace of Despretz, were built, but no marked progress was made until the invention of the electric generator. All through the first half of the nineteenth century a search was made for suitable electrode material. The metals were found to be unsuited for most furnace work as they could only be used in channels to hold them when molten.

The result of all these investigations was that carbon electrodes became standard accessories to the electric furnace. Of the various forms of carbon available, little blocks of retort carbon sawed from the deposits formed in gas retorts were best, as they possessed the highest strength and lowest electrical resistivity. This material possessed several properties, however, which caused trouble, and as early as 1849 Despretz complained that after the electrodes had been used for some time the tips swelled irregularly and cracked off owing to conversion to graphite. Furthermore, it was impossible to secure a piece of this material of adequate size to carry the current in the large furnaces on account of the laminated structure.

The invention of the dynamo in 1867 overcame the limitation as to quantity of electrical energy available. This gave a fresh impetus to electric furnace investigations, and there was an almost immediate demand for larger electrodes. It was evident from the earlier investigations that such electrodes must be of carbon and must be a fabricated article as no natural carbon of the required uniformity, conductivity and strength existed.

THE FIRST FABRICATED CARBON

There is some question as to who made the first piece of fabricated carbon, but as early as 1858 a patent was granted in the United States to De Grasses B. Fowler of New York for a method of making carbon plates by mixing pulverized coke with tar, forming the mixture under pressure in molds, packing the piece in lime and heating slowly in an air-tight box to drive off the volatile matter. It is improbable that this patent was commercialized for other than battery plates as the experimental arc light shown at Yale in 1871 used electrodes cut from blocks of retort carbon. There is little doubt that a Frenchman, Carré, gave to the world the first real commercial process for manufacturing carbon electrodes. In 1877 he described the various steps in the process. He was the first to use carbon dust as a protective material for holding the electrodes during the baking process, and he succeeded in producing satisfactory carbon electrodes up to 0.5 in. (1.25 cm.) in diameter. In 1878 Sir W. Siemens used such carbon electrodes in his experimental work, melting metals in radiation arc furnaces of the crucible type.

In America Charles F. Brush, who gave the first public demonstration of arc lighting in Cleveland in 1876, began in 1877 to experiment in the manufacture

of carbon electrodes, using petroleum coke. At first he used the coke raw and molded it into electrodes 0.5 in. square by 12 in. (30.4 cm.) long in a hand press. Such electrodes shrank so much in baking that he invented the calcination process for removing the volatile matter from the coke prior to its fabrication into an electrode. As the pressures given by the hand press were too low to impart the requisite density to the molded carbon mass, he designed a hydraulic press.

By the year 1878 Mr. Brush was manufacturing these carbon electrodes on a commercial scale and gradually developed the method used for molding round electrodes 0.5 in. in diameter by 12 in. long. It was electrodes such as these that were used by Hall in 1886 in his experiments for the production of metallic aluminum.

As the small molded electrode was an expensive article to form, the extrusion process was developed. In this process the plastic carbon mix was molded into short, thick cylinders, which were placed in a heavy steel cylinder tapering at one end to a small opening or die. Through this opening the mix was extruded by hydraulic pressure applied from the rear end of the cylinder. Many different kinds of extrusion apparatus were tried for this work, including adaptations of the pug mills used commonly in brick work. None of the existing extrusion machines, however, proved capable of handling the carbon mix, and a new type of extrusion machine designed especially for carbon work had to be developed. Such extrusion machines capable of forming carbons up to 1-in. or 1½-in. (2.5-cm. or 3.8-cm.) diameter were in operation by 1895.

EARLY NEEDS FOR LARGE ELECTRODES

The demand for the first large electrodes came from the Pittsburgh Reduction Company, operating the Hall metallic aluminum process. For its commercial furnace the company wanted an electrode 3 in. (7.6 cm.) in diameter by 18 in. (45.7 cm.) long. At first it was considered impossible to make so large an electrode as no presses then made had carbon cylinders of sufficient diameter. The machine designers, however, proved equal to the task, and a new extrusion press was built with a steel cylinder 1½ ft. (45.7 cm.) in diameter to hold the carbon mix. By 1898 so many of the 3-in. electrodes had been made that the large-electrode industry can be said to have become established.

From 1898 on the growth of the industry was very rapid. The development of great quantities of hydroelectric power at Niagara Falls gave an impetus to the electric furnace art second only to the invention of the dynamo itself. Scattered through the closing years of the nineteenth century there were many discoveries of electric furnace products. By 1900 calcium carbide, carborundum and graphite were being produced commercially and electrodes up to 8 in. (20.3 cm.) in diameter had been made to lead the current into the furnace necessary for such manufacture. The decade which had just closed had seen electric furnaces grow from less than 100 hp. to more than 1,000 hp. in single units, and the electrodes for such furnaces had grown from pencils weighing less than ½ lb. (0.23 kg.) to cylinders weighing over 100 lb. (45 kg.).

The first decade of the twentieth century, while perhaps less fruitful in fundamental discoveries in high-temperature chemistry, was marked by a striking commercialization of electric furnace products. This increased demand led to larger and larger furnaces, requiring larger and larger electrodes. Many attempts were made to meet these demands by building up large electrodes from small slabs of baked carbon. The patent literature during this period is replete with examples of ingenious proposals for accomplishing such fabrication. None of them gave really satisfactory results. There are several reasons why this should have been so. If no bonding material was used to unite the individual slabs, expensive machining was required to fit them together and dowel them in place. Even if this was so well done that the mass possessed adequate mechanical strength, the contacts offered variable resistance, which resulted in local hot spots with subsequent burning and breakage. If a bond was used to unite the slabs, the shrinkage of such material in baking set up stresses which caused breakage of the individual members later on. Furthermore, the contacts between the individual members were still of variable resistance, and it was seldom that the mass as a whole possessed adequate mechanical strength.

ATTEMPTS TO PRODUCE MONOLITHIC ELECTRODES

It was obvious from these experiments that such large electrodes to be satisfactory must be monolithic. Larger extrusion presses were built capable of forming electrodes up to 12 in. in diameter. Such electrodes, however, gave a great deal of trouble in use on account of a tendency to crack when subjected to rapid temperature changes. Some manufacturers believed that this difficulty could be overcome if the internal defects incident to forming the electrode by the extrusion process were eliminated. This led to experiments both in Europe and America with what is known as the "tamping process."

In the tamping process the carbon mix is rammed into molds of the desired size, the molds being subsequently opened and the formed electrode removed for baking. At first this ramming of the mix was done by hand, but the pressure developed in this way proved inadequate to impart the required strength to the mass. Later on mechanical rammers were built capable of striking heavier blows. Although there was some improvement in the electrode due to the reduction of the internal defects known as "cones," the tamping process did not produce satisfactory electrodes from the fine-grain petroleum coke mix in use at that time.

In order to overcome the breakage which was common to such electrodes, attempts were made to reinforce the carbon mass with rods of baked carbon or rods of metal or even woven-wire screens, but none of these reinforcements accomplished the desired result. The difference in expansion between the metal and the carbon caused cracking. Furthermore, the shrinkage of the carbon bond in baking caused it to draw away from the reinforcement so that there was really no union between the two.

The first real improvement was made with retort carbon. This material when used in the so-called "concrete mixes" gave large electrodes which were able to withstand the stresses caused by rapid temperature changes without breakage. Experience showed, however, that retort carbon was extremely variable in composition, some kinds being very dense while other kinds occurring in the same retort were light and porous with no higher strength than is possessed by petroleum coke. The search for stronger carbon materials was continued. Finally certain forms of dense, low-ash anthracite were selected as most promising. This material required quite

different dressing from petroleum coke, but after satisfactory methods of calcination, crushing and sizing had been worked out it gave as good electrodes as had been made with retort carbon.

ELECTRODE REQUIREMENTS OF THE ELECTRIC FURNACE

During this ten-year period a number of other electric furnace industries had become well established, as ferro-alloys, aluminous abrasives, carbon bisulphide and phosphorus, and lastly electric steel.

The use of the electric steel furnace for melting down cold scrap imposed more difficult conditions on the electrodes than they had ever been called upon to meet. Not only were larger electrodes demanded for open-arc service than before, but the varying short-circuit conditions incident to melting down a cold charge caused the arc to be concentrated first on one spot on the electrode tip, heating it rapidly to incandescence, and then the arc jumped to a new spot, thus causing uneven expansion in the section, with resulting breaking stresses. As such stresses increase as the diameter of the electrode increases, attempts were made to get the required current-carrying capacity in an electrode by using several small graphite electrodes in a clover-leaf bundle instead of the single large electrode. The mechanical weakness of such an arrangement, together with its rapid oxidation, caused spindling and breakage of the component pieces. These results confirmed the earlier view that electrodes to be successful must be as nearly as possible monolithic. The manufacturers of hydraulic presses in both Europe and America built new machines combining the tamping and extrusion principles in an attempt to overcome the internal defects which had hitherto caused trouble in extruded electrodes. In some of these machines the mix, instead of being made up in a relatively small cylinder before extrusion, was poured loose into the extrusion chamber and compressed in it hydraulically. Other press manufacturers provided for molding of cylinders of mix of the full size of the extrusion cylinder. To these cartridges a low temperature heat treatment was given, and they were then shoved into the extrusion cylinder and formed into electrodes. All of these improvements in forming methods made improvements in the internal structure of the electrode, so that by 1910 fairly reliable electrodes were made up to 16 in. (40.6 cm.) in diameter, weighing over 1,000 lb. (450 kg.)

The second decade of the twentieth century was marked by the Great War, which caused an unprecedented demand for electric furnace products. The manufacturing capacities in all lines were stretched to the utmost. Larger and larger furnaces were built, mammoths consuming 20,000 hp. apiece, or as much as the connected load of many a fair-sized city. For such furnaces electrodes weighing over a ton apiece and many tons in the assembly have been made. Much has already been written to show the fundamental character of electric furnace products in the manufacture of munitions, calcium carbide for the miners, the host of ferro alloys for the steel makers, fixed nitrogen for explosives, abrasives for finishing shells and machine guns, aluminum, magnesium and phosphorus, all requiring electrodes for their production.

For the manufacture of such electrodes retorts glowing incandescent with the burden of carbon in the purifying fire have been devised—retorts requiring for their success the very electrodes in whose production they have played a part. Mills whose manganese steel parts came from the electric furnace crunch and rumble as they crush the crude carbon to finest dust. Towering presses, throbbing as if from the effort, squeeze the steaming masses into shape. Cavernous furnaces in which tides of heat ebb and flow in never-ending cycle drive out the oils from the plastic mass, leaving it hard as stone and able to carry its load when all other substances are molten.

Now we are at peace, the abnormal industrial requirements of the war are over, and we can quietly take stock of our dependence upon electric furnace products for the comforts of our daily life. Call with me for a moment at the modern home at breakfast time. As the door to the kitchen opens you catch a glimpse of the electric range with spun-aluminum pans and cast-aluminum griddles, electric furnace products. The heating units in the range are of the cast-in type, with resistance wire made in the electric furnace from metals which were themselves reduced in the electric furnace. The resistance wire running at brilliant heat is insulated from the iron casting by a snow-white powder whose purity is guaranteed beyond question by its production in the electric furnace. The gleaming white of the enameled sink may well be due to the oxides of titanium or zirconium, electric furnace products. That steel knife was ground to shape with silicon carbide, and the stainless metal with which you cut your orange was not silver but an alloy made in the electric furnace.

DIVERSITY OF PRODUCTS MADE IN THE MODERN ELECTRIC FURNACE

As you bid the family good-by you note the beautifully formed brass fittings on the door, castings from the electric brass furnace. With a whir the motor starts —the pistons of aluminum, the axles of chrome-vanadium steel, the machine parts turned first with high-speed steel and finished by grinding with aluminous abrasives, even the tires made with the aid of carbide bisulphide, all electric furnace products. You reach your office and light a cigarette. The phosphorus on the match came from the electric furnace.

We will not follow all through the day the points where electric furnace products play an important part, but remember that when you ordered that new band saw you specified electric steel. Those new punches were made from molybdenum steel. That bolt of cloth was woven from cotton grown on fields fertilized by potash and phosphate, wrested from the native rock in the electric furnace, and by the nitrates which the electric furnace fixed from the air. When the miners tore that carload of coal from the bosom of old Mother Earth their way was lighted by gas from calcium carbide, an electric furnace product, and the same kind of gas was used by the man who welded that break in the fender of your machine to stop the rattle which irritated you.

Night comes and your home is brilliant with tungsten lights, the filament of electric furnace metal. Even the flashlamp on the table at your bedside derives its energy in part from carbon prepared in the electric furnace, and for the operation of all of these electric furnaces electrodes were required.

The arc was of little practical use without the dynamo, and it in turn could do only a little work until the great waterfalls had been harnessed; but with these the electric furnace, with the aid of the electrode to link them together, has become an important factor in the production of the comforts and more and more of the necessities of life.

Curves for Quick Solution of Power Loss and Voltage Drop Problems

FIG. 1—POWER LOSS IN PERCENTAGE OF DELIVERED POWER

The curves apply to three-phase lines only. For single-phase multiply scale by two.

To Use Chart: 1. Reduce voltage to an equivalent secondary voltage within the limits of the chart (0—150 volts) by dividing by a convenient ratio, 2, 10, 200, etc.

2. Locate intersection of voltage arc with power factor diagonal (E cos θ).

3. Intersection of this ordinate with curve for given wire size gives per cent power loss on scale at left.

4. Divide scale reading by the square of ratio used in 1, and multiply by distance in thousands of feet and load in kilowatts.

Result is total per cent power loss on line.

FIG. 2—PERCENTAGE OF DELIVERED POWER LOST PER KILOWATT PER 1,000 FT.

This applies to 4,600-volt three-phase line only. For single-phase line multiply figure given by curve by two. To obtain per cent voltage drop use these curves in conjunction with quantity B given in Fig. 4.

FIG. 3—PERCENTAGE (OF DELIVERED VOLTAGE) DROP PER 1,000 FT.

These curves apply to three-phase 4,600-volt lines with 27-in. spacing and 80 per cent power factor.

FIGS. 4A AND 4B—VOLTAGE DROP IS READILY DETERMINED AFTER POWER LOSS HAS BEEN FOUND

B, given by the curves, is the ratio V/P, where V = voltage in per cent of delivered volts and P = power loss in per cent of delivered power. Fig. 4a gives values of B for power factors 50, 60, 70, 80 and 90 per cent and 4b for 90, 95 and 100 per cent.

To Use Chart: 1. Determine value of x/r for size and spacing of wire used, from curves on right.

2. Determine value of B for this value of x/r from proper curve on left.

3. Multiply by per cent power loss (from other curves) for per cent volts drop, $V(=PB)$.

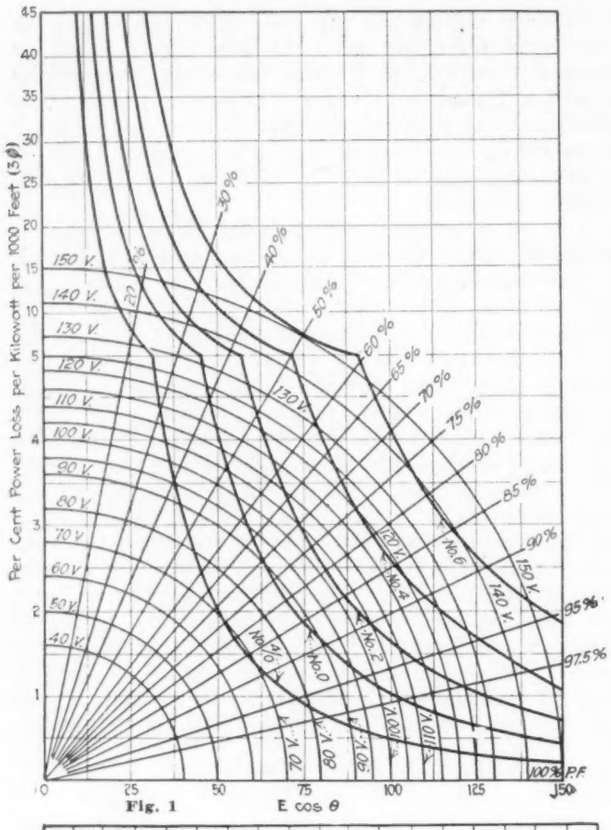


Fig. 1

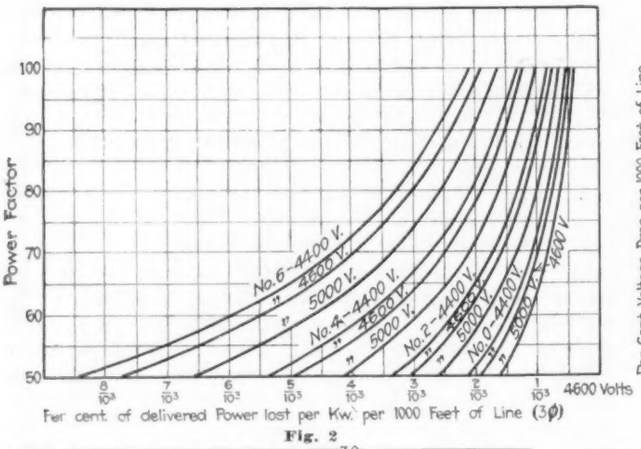

Power Factor
No. 6 - 4400 V.
" 4600 V.
" 5000 V.
No. 4 - 4400 V.
" 4600 V.
" 5000 V.
No. 2 - 4400 V.
" 4600 V.
" 5000 V.
No. 0 - 4400 V.
" 4600 V.
" 5000 V.
4600 Volts
Per cent. of delivered Power lost per Kw. per 1000 Feet of Line (3φ)

Fig. 2

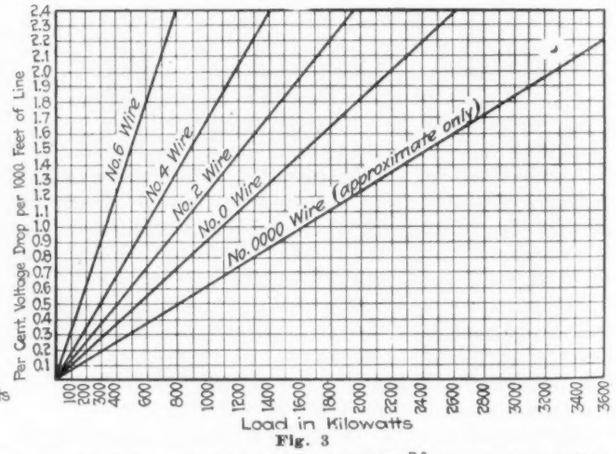

Per Cent Voltage Drop per 1000 Feet of Line
No. 6 Wire
No. 4 Wire
No. 2 Wire
No. 0 Wire
No. 0000 Wire (approximate only)
Load in Kilowatts

Fig. 3

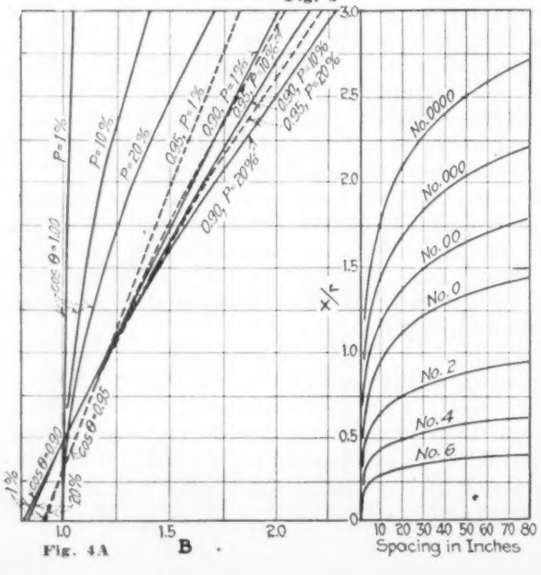


Fig. 4A

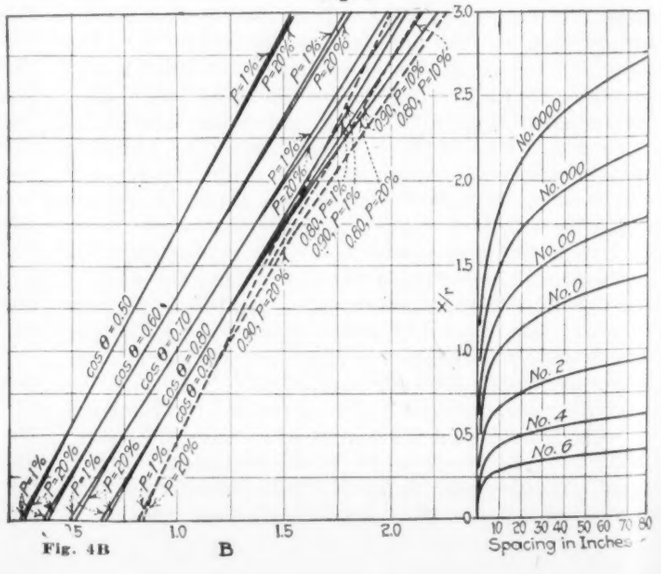


Fig. 4B

Simplifying Line Loss and Drop Problems

Power Loss Is Determined from Charts with Minimum Computation and Voltage Drop Is Readily Derived from This—Charts Do Not Cover Charging Current and Corona Problems

By H. P. SEELYE
Distribution Engineer's Department, Detroit Edison Company

PROBABLY the two quantities most often computed in the design of lines for electrical transmission and distribution are the power loss and the voltage drop. The former is always important in determining the economy of a design. Upon the latter depends the quality of service rendered. The most usual case of power loss is that due to the resistance of the conductor, *i.e.*, the I^2R loss. In high-tension transmission lines leakage losses and corona losses become important. Charging current also has an effect or I^2R loss. Such problems, however, are comparatively rare in the work of most engineers and warrant special treatment when encountered. In the majority of problems I^2R loss is all that need be considered.

If D = length of line in feet,
W = the load at the receiver end in watts (kilowatts $\times$ 1,000),
E = the receiver voltage,
A = cross-sectional area of conductor in circular mils,
ρ = resistivity of conductor material in ohms per mil-foot,
$\cos\theta$ = the power factor of the load W.

$$I^2R \text{ loss} = \left(\frac{W}{E\cos\theta}\right)^2 \frac{\rho D}{A} \times 2 \text{ watts (for single-phase)},$$

$$I^2R \text{ loss} = \left(\frac{W}{\sqrt{3}\,E\cos\theta}\right)^2 \frac{\rho D}{A} \times 3 \text{ watts (for three-phase)}.$$

If P = per cent power loss in terms of power delivered,

$$\frac{P}{100} = \frac{2W^2\rho D}{(E\cos\theta)^2 A} \times \frac{1}{W}, \quad P = \frac{200W\rho D}{(E\cos\theta)^2 A} \text{ (for single-phase)};$$

$$\frac{P}{100} = \frac{W^2\rho D}{(E\cos\theta)^2 A} \times \frac{1}{W}, \quad P = \frac{100W\rho D}{(E\cos\theta)^2 A} \text{ (for three-phase)}.$$

For the same load, same voltage between conductors and the same conductor size, the loss with single-phase is twice that with three-phase.

If it is desired to consider the load, voltage and power factor at the source instead of at the receiver, if

W' = load at source in watts,
E' = voltage at source,
$\cos\theta'$ = power factor at source.

The line loss in percentage of load at source

$$P' = \frac{200\,W'\rho D}{(E'\cos\theta')^2 A} \text{ (for single-phase)},$$

$$P' = \frac{100\,W'\rho D}{(E'\cos\theta')^2 A} \text{ (for three phase)}.$$

For copper conductor $\rho = 10.8$ approximately. If load is expressed in kilowatts (kw.), the formula becomes

$$P = \frac{2.16 \times 10^6 \times \text{kw. } D}{(E\cos\theta)^2 A} \text{ (for single-phase)},$$

$$P = \frac{1.08 \times 10^6 \times \text{kw. } D}{(E\cos\theta)^2 A} \text{ (for three-phase)}.$$

These formulas are comparatively easy to use. However, it is believed the work may be somewhat simplified, especially where a large number of such computations are to be made, by use of the accompanying chart (Fig. 1). The use of this chart reduces the computation to a simple multiplication of round numbers.

How to Use the Power-Loss Chart

A series of circular arcs (with the center at O, O) are drawn, each representing a given voltage. Voltages range from 0 to 150, but as will be shown below, the same arcs may be used for any voltage. Diagonal straight lines are drawn through O, O at various slopes, each representing a given power factor. It is evident that the abscissa of the intersection of any arc with any diagonal gives the corresponding value of $E\cos\theta$.

For each standard wire size considered, a curve is now plotted between $P \div$ (kw. D/1,000) and $E\cos\theta$, giving for any voltage, power factor and wire size the per cent power loss per kilowatt per 1,000 ft. Curves for other sizes of wire can be easily added if desired. The upper part of these curves was drawn to a condensed scale to give a greater range of values in the more unusual cases. The curves here shown are for three-phase. The power loss for single-phase would be twice the values shown for three-phase.

These curves are used according to the following rules:

1. Reduce the voltage considered to any equivalent secondary voltage within the scale of the chart (less than 150) by dividing by some convenient transformation ratio such as 2, 4, 10, 20, 200, 400, 1,000, etc.
2. Locate intersection of voltage arc and power-factor diagonal.
3. The intersection of the vertical through this point with the curve for the proper wire size gives the value of P on scale at left.
4. Divide this scale, reading by the square of the transformation ratio used, to give per cent power loss per kilowatt per 1,000 ft. for the given voltage. Multiply by the number of kilowatts and by the length of line in thousands of feet for total per cent power loss in terms of power delivered. (If line is single-phase multiply this quantity by 2.)

Take for example the following problem:

Load, 1,200 kw.; power factor, 75 per cent; voltage at receiver, 4,400; wire size, No. 3/0 (three-phase); distance, 8,000 ft.

4,400/40 = 110 (transformation ratio = 40).
Power loss = (1.51 $\times$ 1,200 $\times$ 8) $\div$ (40 $\times$ 40)
= 9.06, or 108.7 kw.

Voltage Drop Readily Determined from Power-Loss Data

The drop in voltage from source to receiver involves more complicated equations. When relating to high-tension lines the problem involves line capacity, etc., and warrants special consideration. For medium-volt-

age and low-voltage problems, however, it is sufficient to consider inductive reactance only, and the equation becomes the well-known

$$\frac{V}{100} = \frac{\sqrt{(E\cos\theta + \sqrt{3}\,RID)^2 + (E\sin\theta + \sqrt{3}\,XID)^2} - E}{E}$$

(for three-phase lines)

$$= \sqrt{\left(\cos\theta + \frac{\sqrt{3}\,RID}{E}\right)^2 + \left(\sin\theta + \frac{\sqrt{3}\,XID}{E}\right)^2} - 1$$

Where V = per cent voltage drop in terms of receiver voltage,
R = resistance in ohms per foot,
X = inductive reactance in ohms per foot,
D = distance from source to receiver in feet,
I = current per wire.

But

$$P = \text{per cent power loss} = \frac{100\,WD}{(E\cos\theta)^2\,A} = \frac{100\sqrt{3}\,RID}{E\cos\theta} \text{ (see above).}$$

Substituting

$$\frac{V}{100} = \sqrt{(\cos\theta + \frac{P}{100}\cos\theta)^2 + (\sin\theta + \frac{P}{100}\frac{X}{R}\cos\theta)} - 1$$

$$= \cos\theta\sqrt{\left(1 + \frac{P}{100}\right)^2 + \left(\tan\theta + \frac{P}{100}\frac{X}{R}\right)^2} - 1$$

$$\frac{V}{P} = B = \frac{100\cos\theta}{P}\sqrt{\left(1 + \frac{P}{100}\right)^2 + \left(\tan\theta + \frac{P}{100}\frac{X}{R}\right)^2} - \frac{100}{P}.$$

(The above computation is for three-phase, but the resulting expression for B is the same for single-phase.)

B, then, is a quantity expressing the relation between per cent voltage drop and per cent power loss. It depends on the power factor ($\cos\theta$), size and spacing of conductors (X/R) and per cent power loss (P), but is independent of load or voltage. It is evident that if B is known the per cent voltage drop may be easily obtained from the per cent power loss by the simple relation $V = BP$.

B may be plotted as shown in the accompanying curves (Figs. 4a and b). Since the variation of B with P is not great excepting for high power factor and large conductors, three fixed values of P were chosen which cover the usual range of problems, *i.e.*, 1 per cent, 10 per cent and 20 per cent. For each power factor a curve between B and X/R is plotted for each of these values of P. Other values of P may be interpolated if necessary. The value of X/R is shown directly by the curves on the right for standard sizes of conductor and any spacing.

The use of the curves is as follows: Locate the point on the X/R curve for the given wire size and spacing. (For three-phase, unequal spacing, use the equivalent spacing, $S = \sqrt{S_1S_2S_3}$). Pass across the sheet to the left on the horizontal through this point until it intersects the curve for the given power factor and value of P. The corresponding value of B is found on the scale at the bottom. If this is multiplied by the value of P computed from Fig. 1, the desired value of V (per cent voltage drop) is obtained.

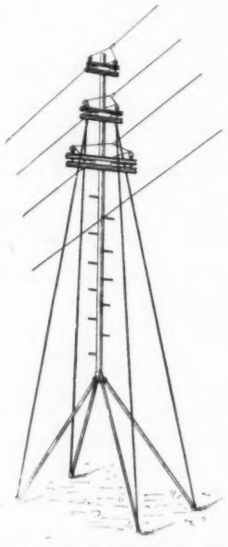
Example.—In the example given above for the determination of P, let the spacing between the wires be 28 in., 28 in., 56 in. The equivalent spacing $= \sqrt{28 \times 28 \times 56} = 35$ in. Interpolating between the 70 per cent and 80 per cent power factor curves, $B = 1.18$, $V = 1.18 \times 9.06 = 10.7$ per cent, or 470 volts.

The curves given here are general and may be used for any voltage, load, length of line and spacing between conductors. The range of wire sizes and power factor is more limited, but the curves could be easily extended to cover any desired value. For every-day use on the problems arising on any given system less general curves may be derived from these which will still further simplify computations. As an example, Fig. 2 shows a set of curves plotted for work on 4,600-volt lines. Three curves are shown for each wire size giving a range from 4,400 volts to 5,000 volts. For any power factor (lower scale) the scale on the left gives the per cent power loss per kilowatt per 1,000 ft.

Fig. 3 shows another special curve giving per cent voltage drop per 1,000 ft. of line for 4,600 volts, three-phase, 80 per cent power factor, 27-in. spacing. It is a comparatively simple matter to derive any such special curves desired by use of the general curves.

A Flexible Type of Transmission Tower

A NEW type of transmission-line power is described in the *Commonwealth Engineer* (Australia). The tower is a four-sided structure and consists of struts of weldless steel tubes and ties of steel-wire ropes braced together, making it exceedingly light and self-contained. It is unaffected by any settling of foundation, and any variation in temperature, whatever the range, will not set up internal strains. The connection between the upper strut and the lower struts is a simple casting with projections into the tubes to keep them in position. The casting is held in position by the weight of the structure above it, consequently bolting, riveting or screwing are unnecessary. The galvanized-wire rope stays are attached to the upper strut by a clamp or by incorporating the clamp in a cross-arm firmly fastened to the strut. Connection to the lower struts is affected either by the rope being passed around the strut and a malleable cast bearer bolted on or by fitting a clamp. The rope end is finished off by a thimble and wire rope clamps. The cross-arms are of channel iron. Should increased spacing be required, as in the case of very high voltages, two tubes instead of one are used for the upper strut. This maintains the strength of the tower and at the same time preserves its flexibility and simplicity. The ground reaction, owing to the wide base of the tower, is small; it is dealt with by means of buckled plates bolted to the ends of the tubes. No concrete is required for the foundations. The longest span thus far erected is 1,800 ft. (550 m.), but it is said that a span of 3,000 ft. (900 m.) is now in the course of erection.



FLEXIBLE TOWER USED IN AUSTRALIA

Voltage, 22,000; height, 42 ft. (for span of 1,432 ft.); conductor, 0.1 sq.in. copper. Ground wire is below line wires.

Station Electrical Layout for Supplying Local and Regional Service

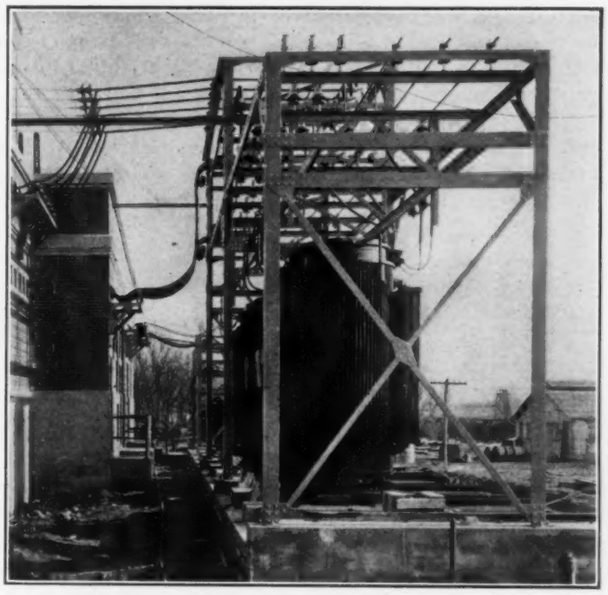
Flexibility and Simplicity of Design Effectively Combined in the South Meadow Station of the Hartford Electric Light Company—Symmetrical Development by Sections to Meet Dual Service

TYPIFYING plants which must meet the requirements of more than local service, the new South Meadow station of the Hartford Electric Light & Power Company is of interest from both the mechanical and the electrical viewpoint. This plant is intended to operate as a key plant for giving both regional and local service so that particular attention had to be given to insuring continuity and flexibility of service. Some of the salient features of the mechanical part of the plant were discussed in the Dec. 10 issue of the ELECTRICAL WORLD, and those of the electrical layout will be considered in the current issue. Among the features of particular interest in this discussion are the arrangement of the electrical bay, the precautions taken to prevent short circuits, the supporting of buses and circuits to resist mechanical stresses set up by short circuits, the segregation of oil circuit breakers and instrument transformers, the arrangements of reactors, the placing of virtually all transformers outdoors, and the use of truck-type switchboards for station service control.

As illustrated in the Dec. 10 issue, the electrical bay has four floors with a basement under part of it. Of electrical interest on the top floor are the operating room and load dispatcher's quarters. Below is the oil circuit-breaker room, with equipment mounted directly above the bus room to minimize length of connections and prevent fires and gases in the switch room communicating to the bus room. In the bus room there is a longitudinal wall which divides it into two main sections. On the floor below are compartments for existing and future reactors and instrument transformers, and beneath these is the station-service room. Adjoining the electrical bay on the outside is a cable house of two stories providing for convenient connection of the station circuits with the outgoing underground circuits.

With minor exceptions, all transformers, including those for station service, are outdoors. For the time being distribution from the South Meadow station will be largely at 11,000 volts, but construction of an outdoor transformer and switching station connecting with the 66,000-volt lines of the Connecticut Power Company has been begun. This will supersede equipment now serving this purpose near the Dutch Point station of the Hartford company. At present two 7,500-kva., three-phase, self-cooled, 11,000-volt delta/66,000-volt Y-connected transformers are installed with their neutrals grounded. This rating may be increased by adding a cooling system.

Features of the main electrical circuits and switching arrangements for providing this dual local and regional service are indicated in the accompanying line drawing. As shown, there will ultimately be two 11,000-volt buses, to either of which any 11,000-volt circuits may be connected through selector oil switches. Only one is provided now, however. Among other features which this diagram shows are the positions of reactors and the use of oxide-film static dischargers on the buses. So far protective reactors are installed only in the Dutch Point tie lines, although space is provided for such equipment in each of the 11,000-volt circuits, including the generator leads. The tie-line reactors are designed to give 15 per cent voltage drop at the rated circuit current and the power-feeder reactors 3 per cent.



THE 11,000/2,300-VOLT STATION-SERVICE TRANSFORMERS ARE OUTDOORS

The 11,000-volt, 25,000-kva. generators, one of which is now installed, will be arranged in a single row with their longitudinal axes running the length of the turbine hall. These units will be protected by differential redays. The neutral from each generator will be brought through the air-duct wall into a chamber below the generator platform where current transformers are inserted and connections made through oil circuit breakers with a neutral grounding bus running the length of the turbine hall. Normally only one generator will be connected to the ground bus, which has a 5-ohm, 1,300-amp. resistor between it and the ground. This can be short-circuited when it is necessary to burn out a grounded cable. In these chambers are also the generator and exciter field rheostats and switches, which are remotely controlled.

The closed system of generator air cooling is used, the chamber for continuous recirculation and water spraying being under the generator end of the turbine foundation. Two sets of sprays are provided, one in

the uptake to each end of the generator. Compact yet ample space, reduced air velocity and a flexible damper control are permitted with this arrangement. Turbine-room air can be recirculated if desired or, in cold weather, generator air can be used for warming the turbine room and reducing roof condensation. In case of interrupted water supply a quick change to the open system of ventilation can be accomplished by means of interlocked dampers.

Each generator will have a direct-connected exciter, but two reserve steam-driven exciters will be provided. One of these is installed now. Parallel operation of the exciters is not contemplated, although the generator field circuits can be readily transferred from their individual to the reserve exciters without interrupting generator operations.

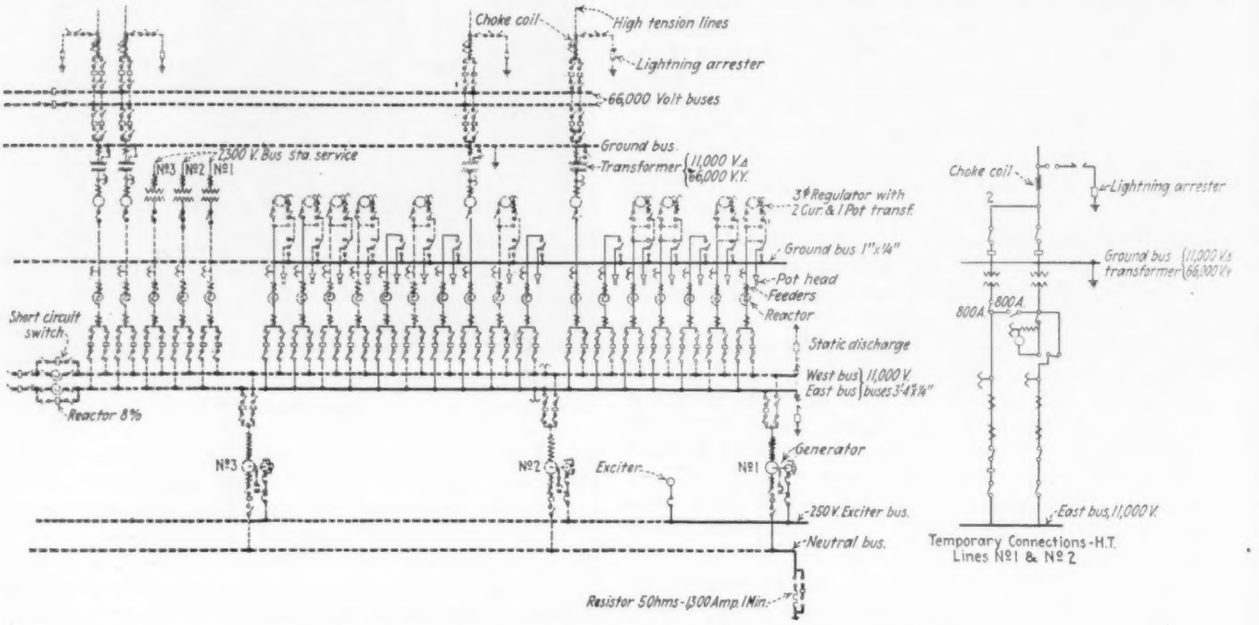
The generator circuits are equipped with H-9 oil circuit breakers and all other 11,000-volt circuits with H-6 breakers. As mentioned before, these switches are on the floor above the bus room, with their disconnecting switches in subcompartments immediately below them. This arrangement not only enables the operator to see both simultaneously and reduces length of circuits, but minimizes the possibility of communicating to the bus room any flames or gases arising from the circuit breakers or accidental opening of disconnecting switches in loaded circuits. Passage of conducting gases from one switch cell to another is minimized by vertical barriers separating individual tanks and vertical ribs on these barriers separating adjacent cell doors. The spreading of gases is further prevented by artificial ventilation.

In the ceiling directly over each circuit breaker inserts are provided for eyebolts to be used in dismounting circuit breakers. At one end of the room is a tap and drain connected directly with an oil tank and filter in another part of the station so that circuit-breaker tanks may be filled without leaving the room.

The 11,000-volt buses are supported on special glazed insulators so attached to a concrete wall forming the back of the bus compartment as to be in compression under short-circuit stresses. Between the buses are precast concrete slabs which carry nothing more than their own assembled weights. The main supporting wall also serves as a barrier to the passage of any gases between the bus compartment and circuit connections. Access to the buses is afforded only from the passageway through openings covered with asbestos doors. All insulators supporting 11,000-volt circuits outside of the main buses are of the post type with a smooth white porcelain finish that minimizes the collection of dust and makes it conspicuous if it does accumulate.

To facilitate ventilation, inspection and cleaning of the reactors on the floor below, the three units for each circuit will be arranged in tiers, one above the other, those for adjacent circuits being on opposite sides of a central division wall. The reactor compartments are made of concrete brick with concrete shelves.

Along the outer station wall in the reactor room are all feeder potential transformer compartments. There are two transformers per circuit. Each one is supplied with two fuses having series protective resistors designed to limit the current and consequently the gases resulting from fuse explosion.



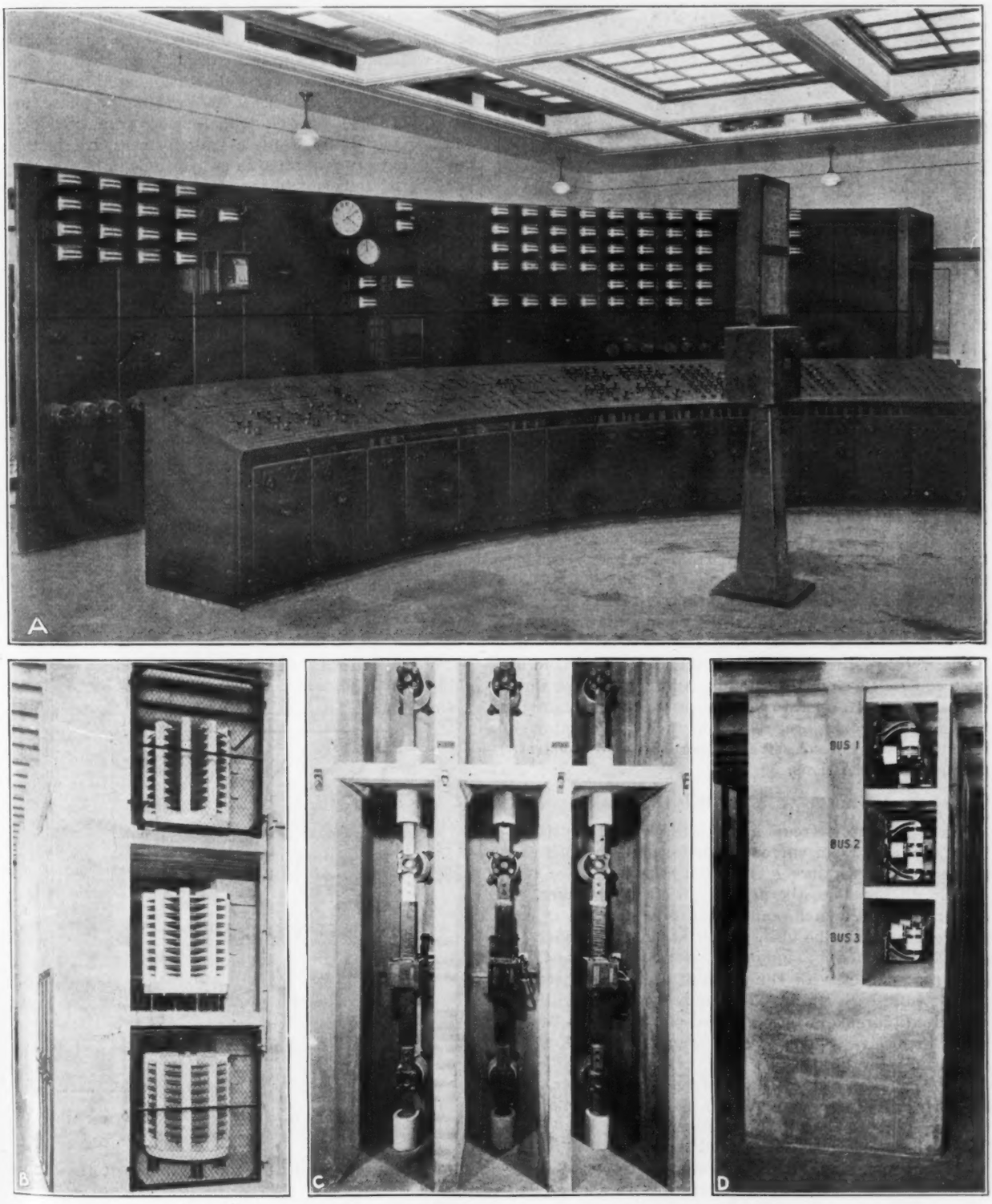
ULTIMATE AND TEMPORARY CONNECTIONS OF MAIN ELECTRICAL CIRCUITS

From the electrical bay the 11,000-volt outgoing circuits run into the cable house, where they connect with potheads directly above the corresponding underground ducts. Above the potheads are double-throw switches which make it possible to connect them either to ground or to a circuit from the electrical bay. If it is necessary to provide additional circuit breakers in the outgoing circuits, they may be placed directly above the cable house. Arrangements are such that within a feeder section any feeder may be connected with any underground cable at any time, thus eliminating cable crosses in manholes.

In line with the most modern accepted practice, the control of the main generators, electrical circuits and switches is centered in a benchboard back of which is a vertical panelboard bearing the principal instruments required in operating these switches. The relays are also mounted thereon. Parallel and back of this board

is another vertical panelboard carrying the watt-hour meters and curve-drawing instruments. Between the boards in the floor is a pull box approximately 1 ft. deep into which all instrument and control circuits are brought. All wiring in this box is encased in flexible metal conduit, the panel wires being brought up through the metal floor plates to terminal boards at the base of the panel on which test links are provided for the calibration of instruments and meters. The 11,000-volt side of the station-service transformers is also controlled from the main operating room.

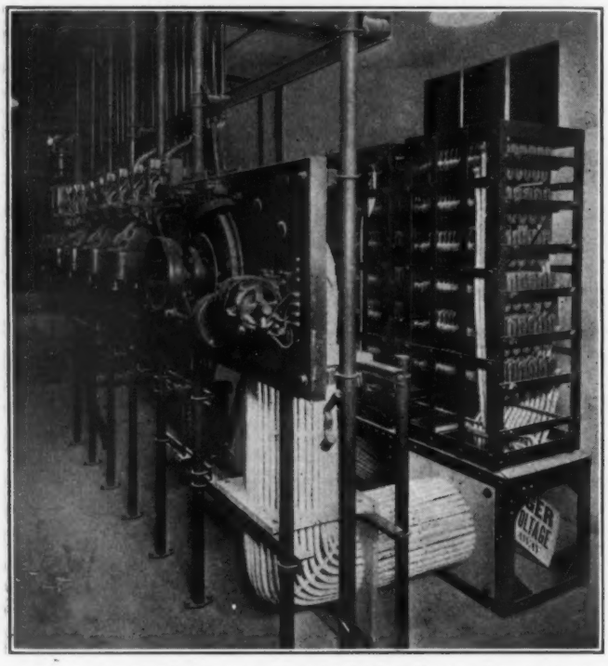
In addition to the usual instruments provided, each generator circuit is equipped with a wattless component indicator, a temperature indicator, an ammeter in the



MAIN CONTROL ROOM AND INTERESTING ELECTRICAL GALLERY COMPARTMENTS

A—Electrical operator commands view of all indicating instruments and control switches. B—Reactors for each circuit are arranged in tiers, adjacent circuits being on opposite side of the division wall. C—Relay current transformers accessible for inspection and convenient wiring. D—Bus insulators arranged to be in compression under short circuit.

neutral ground circuit, and provision for a printometer demand indicator. The 11,000-volt feeder panels also have wattless-component indicators and provision for graphic wattmeters and demand printometers. All graphic-instrument mechanisms are operated by small



GENERATOR AND EXCITER FIELD RHEOSTATS ARE BELOW GENERATOR PLATFORM AND REMOTELY CONTROLLED

synchronous motors controlled from a master-frequency source.

Convenient to the control bench is a signal stand for exchanging signals with the boiler room and turbine hall. Signs indicate the signals sent and received. The load bulletin boards in the boiler room and turbine room are also controlled from this stand. Another feature which helps the chief operator is an annunciator board on which all signals are received, such as opening of circuit breakers, excessive temperatures in apparatus and similar conditions.

THOROUGH RELAY PROTECTION

Each generator circuit is protected by differential relays operated from current transformers in both ends of each phase winding. These relays trip the two main oil circuit breakers, the neutral oil circuit breaker, the generator field switch, and the turbine throttle in case of trouble inside the unit. Each 11,000-volt feeder circuit is protected by induction overload relays. Four tie lines connect with Dutch Point station. These are protected at each end by balanced relays which will open the circuit breakers only in case of trouble in the tie lines themselves. The station transformers have differential relay protection.

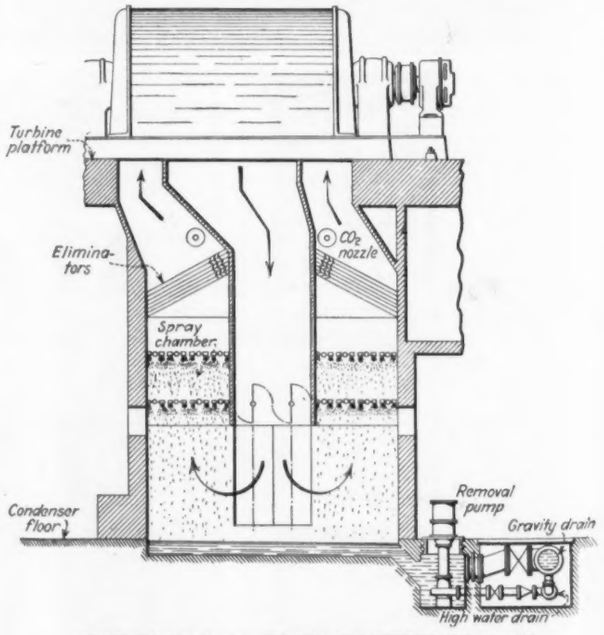
All relays are connected to current transformers having primaries of the bar type to withstand short-circuit stresses. These current transformers are located between the protective reactors and the buses. All instruments are operated from a separate set of current transformers, which in the case of circuits of less than 1,000-amp. capacity are not of the bar type. The instrument transformers are so located in the circuit that the protective reactors are between them and the buses.

In general all station service motors rated at 50 hp. or more are designed for 2,300-volt operation. Smaller units are designed for 220-volt operation. With the exception of a few motors rated at 2½ hp. or less, all the motors are protected by automatic control. The small units are provided with fuses connected in such a way that rupture of a fuse in any phase will open the other phases and thus prevent single-phase operation.

The transformers to serve the 2,300-volt auxiliaries are installed outdoors. Ultimately there will be three banks of station-power transformers, any two of which will be sufficient to carry all station auxiliaries, each bank consisting of three 1,000-kva., single-phase, self-cooled, 11,000/2,300-volt transformers connected delta-delta. Only four of these transformers are installed now. They are connected in two open-delta banks, either bank being sufficient to care for the existing equipment. These transformers are connected to a 2,300-volt ring bus, divided ultimately into three sections. All important 2,300-volt circuits may be supplied from any one of the bus sections, any two of which are sufficient to carry the entire load.

The 220-volt auxiliaries are served by 2,300/230-volt transformers. For the auxiliaries in the turbine room and the electrical bay two banks will ultimately be provided. The boiler-house auxiliaries will have two similar banks. Only one-half of these units are installed, each bank consisting of three 150-kva. units.

Truck-type switchboards installed beneath the electrical bay on a level with the condenser floor control the 2,300-volt side of the station-service transformers and 2,300-volt auxiliaries. This type of board is used because the men who will operate it are not especially familiar with electrical apparatus. A switchboard of the usual type, also in the station-service room, controls the 220-volt auxiliary circuits. A second auxiliary-



RECIRCULATION OF GENERATOR VENTILATING AIR PERMITTED BY SPRAY COOLING

power room is provided in the basement of the turbine room.

The firing aisle in the boiler house, the main turbine room, the switchboard operating room and the load dispatcher's room all obtain natural lighting through sky-

lights in the roof. Artificial lighting is so provided in the boiler house that the firing aisle and space over and back of the boilers is amply illuminated, special lighting being added directly over the stokers, at the water columns, instruments, valves and other points where light is of particular importance. All fixtures in the boiler house have cast-iron outlet boxes with cast-iron hoods and steel reflectors. The sockets are arranged so that smoke and fumes cannot reach the interior. In the ash cellar and similar locations vapor-proof fittings are used and heavy guards are provided wherever necessary.

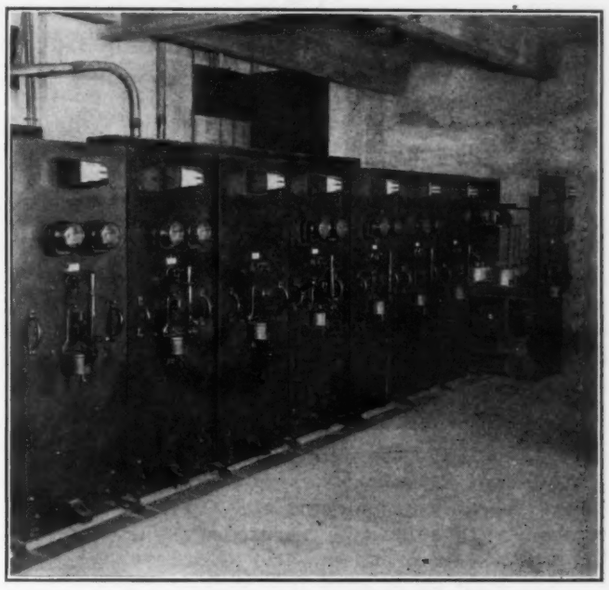
LIGHTING AND VENTILATION

The turbine room is lighted from industrial-type fixtures suspended from the overhead trusses arranged so that general illumination is provided on the condenser floor as well as on the turbine platform. Local lighting around the condensers and auxiliaries is also provided in addition. All of the lighting is supplied normally from lighting transformers with automatic regulators, but in case of trouble on the alternating-current circuits a part of the lamps are automatically connected to the control battery.

The reactors and bus rooms depend entirely on artificial illumination, the circuits being supplied from panels installed in the south end of each room, adjacent to the main operating stairway. Outside these rooms in the adjacent hallways are emergency circuit switches, and in the doors are wired-glass panels covered by a metal slide so that an operator can view the conditions existing in the room before entering. The main switchboard control room is artificially lighted by lamps placed above a glazed ceiling directly under the skylight, thus affording well-diffused light on the switchboard, day or night. Emergency lights are also provided in this room, which are always connected directly to the station battery.

The electrical bay is provided with a ventilating system for all floors, which will prevent the accumulation of heat in such locations as the reactor room and will also quickly remove smoke and gas in case of circuit-breaker trouble. Provision is made so that in cold weather the incoming air can be heated to some extent. Such additional local heating as may be necessary for working comfortably in these rooms during extreme weather will be furnished by electric heaters connected through plug outlets to circuits carried in the walls of the electrical bay.

In general all circuits of 2,300 volts or higher are carried in varnished-cambric cables, and all cables of 750,000 circ.mils or above are provided with rope cores. All control and signal circuits have 30 per cent Para rubber insulation, and all circuits in the boiler house, whether for light or power, are insulated with varnished cambric. All other lighting circuits have the usual type of National Electrical Code insulation.



TRUCK-TYPE SWITCHES CONTROL THE 2,300-VOLT STATION-SERVICE AUXILIARIES

The information on which the foregoing discussion is based was obtained from T. H. Soren, vice-president of the Hartford Electric Light Company, and engineers of Stone & Webster, Inc.

DETAILS OF PRINCIPAL ELECTRICAL EQUIPMENT IN SOUTH MEADOW STATION

Station Service Transformers.—Four 1,000-kva., 11,000/2,300-volt outdoor self-cooled units; six 150-kva., 2,300/230-115-volt; one 100-kva.; one 50-kva.; one 17½-kva., 2,300-230-volt automatic lighting regulator (all General Electric).

Protective Reactors.—Fifteen 250-amp., 15 per cent drop, single-phase reactors with shunt resistors (General Electric).

Ground Resistor.—One 5-ohm, 1,300-amp. (one minute) cast grid resistor (General Electric).

Switching Equipment (11,000-Volt Circuits).—H-9 and H-6 oil circuit breakers, disconnecting switches, switchboards, instruments and instrument transformers (General Electric).

Switching Equipment (2,300-Volt and 220-Volt Circuits).—Truck-type switchboard with K-32A oil circuit breakers and panelboards with K-35 circuit breakers (General Electric).

Storage Battery.—One 60-cell, E-15 154 amp.-hr. battery (Electric Storage Battery Company).

Turbine Signals and Load Bulletins.—Operating pedestal with miniature signs and load bulletins in turbine and boiler room (G-F Signal Company).

Lighting Cabinets.—Double-door, dead-front type with tumbler switches and cartridge fuse (Benjamin Electric Company and Wetmore-Savage Company).

Bus and Cable Supports.—Post and bracket type heavy-duty insulators (General Electric).

Wire and Cable.—Varnished cambric and 30 per cent para rubber insulation (General Electric).

Porcelain Bushings.—11,000-volt floor and wall tubes (Ohio Brass Company and Locke Insulator Manufacturing Company).

Interior Lighting Fixtures.—Pettingell-Andrews Company, Benjamin Electric Manufacturing Company, Holophane Glass Company, Hart & Hegeman Manufacturing Company, National Company.

Yard-Lighting Fixtures.—Floodlamps (General Electric).

Safety Switches.—Inclosed knife switches (Trumbull Electric Manufacturing Company).

Terminals.—Cast copper (Electric Power Equipment Corporation).

Important Accomplishments of the Geological Survey

IN HIS annual report, submitted to Congress on Dec. 7, the Secretary of the Interior lists the following among the important achievements of the Geological Survey during the last fiscal year:

Made surveys in five states for the purpose of classifying lands with relation to their value in connection with the development of water power.

Made reports increasing the power-site reserves from 2,500,000 acres to more than 3,700,000 acres.

Prepared statistical reports on the production of electricity and the consumption of fuel by public utility power plants and continued mapping of transmission lines and power stations.

Prepared and published maps showing power stations and transmission lines in Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New Jersey, Delaware and Maryland and assembled data for similar maps of other states.

Conducted an engineering investigation and prepared an exhaustive report on a proposed "Superpower System"—a comprehensive system for the generation and distribution of electricity for the operation of railroads and manufacturing industries in the region between Boston and Washington.

A Review of Some Rural-Line Fundamentals*

A Practical Presentation of the Reasons Why Rural Service Must Now Be Considered by Most Central Station Companies and the Course to Follow

By J. C. MARTIN
Western Editor ELECTRICAL WORLD

WHY is it, what is it, how shall it be handled, and what are the pitfalls to be avoided, are questions that every business man must answer in some sort of a reasonable way before he can attack any problem with a reasonable hope of finding a successful answer. In a brief way I would like to consider the rural-service problem from the several angles the questions indicate.

WHY IS RURAL SERVICE?

Five years ago the average utility operator east of the Missouri River and a large majority of those between the Rocky Mountains and the Missouri River would have unanimously chorused, "A farmer's fad." The utility men in the semi-arid territory of the mountain and coast states knew that to the farmers in their territory at least rural service was a vital factor in watering the land and making agriculture and the development of the territory possible. In spite of the difficulties involved and the new trails that must be broken an economic need lay back of the demand that would brook no refusal to attempt the solution. The issue in the Middle West and the East has been less clear-cut because the service did not bear so intimate a relation to the development of the territory, which, in fact, had already developed agriculturally without such service. With the war and its aftermath of high cost and scarce labor the farmers in these sections have been brought face to face with a necessity for reducing the cost and the drudgery of farm labor. The development of American farm machinery has accomplished much in this direction in the past fifty years, but those accomplishments are insufficient and economic need is relentlessly forcing the farmer to untried fields in his search for a solution.

The necessity of electric service in the modern home is just as important from an economic standpoint as is its need in the modern factory. It is hardly conceivable that those benefits can be barred to the rural home when, slowly but surely, the benefits of running water, sanitary equipment, home-heating plants and other conveniences have been brought to the farm. Inevitably the farmer has turned to the agency that has been so great an influence in the city home and the industrial life of the nation for help in meeting his problem. The American farm is an industrial establishment different only in form from the factory, and the rural home is simply an average American home.

WHAT IS RURAL SERVICE?

It is nothing more nor less, from a central-station distribution viewpoint, than the city or town distribution system carried into the country. There has been entirely too much discussion of rural distribution lines based on an assumption that they are a new and possibly a fearfully and wonderfully constructed animal that must be handled gingerly for fear it might turn out to be a bull in a china shop or something equally undesirable. The simple fact is that the lines differ from the city lines only in the fact that they are seldom built to carry more than two circuits and in many cases only one. The general weight of the construction may be lighter than the corresponding city lines.

From the viewpoint of load characteristics, available information is meager. The most important fact known is that under the present conditions line and transformer losses at least equal, if they do not exceed, the energy sold to the consumer. There are some indications that the power-factor conditions are such that more plant capacity is required to handle the farm load than would be required if the load were in the city.

The maintenance problems are more difficult and more expense is involved than in city work. The investment per customer is several times greater, but a pertinent fact that must be kept in mind in connection with both these matters is, that in giving the service you are virtually transporting the farm to the city. Of the two the taking of the service to the farm is an infinitely more practical and less expensive measure to the community than taking the farm family to town.

These are some of the principal facts. Our knowledge of their value is all too small. The remedy is comparatively easy to find if utility men will only take the trouble to select specific cases on their own systems and carefully study the results year by year for a few years. By this is meant not merely taking the total investment, maintenance and consumption figures the bookkeeper hands out but two or three typical cases on every system having such service should be taken and detail accounts set up to cover the various items of investment, operation and maintenance. Meters should be installed on the lines and other measures taken to obtain data.

HOW SHALL IT BE HANDLED?

This quesion has been the subject of more dodging and "buck-passing" than almost any other question before the Middle Western utility interests. It is a business proposition and not one of charity. A cardinal business principle is that every business must be profitable to the principals if it is to be continued. Each participant has something that the other can use to better advantage than he can. In this particular problem the cost factors are little known as yet, because utility men have not taken the trouble to find out what they are. The first step in handling business under such conditions is to sit down with each extension as it comes up and analyze it as you would if Jim Jones had asked

*A paper presented before the Kansas Public Service Section of the N. E. L. A. at Hutchinson, Kan., Dec. 9, 1921.

you to supply power at a factory several miles away You are entitled to consider all the items of investment, fixed charges, maintenance and operating charges, return on the property involved in the service and the insurance against losses in the business. When you have evaluated all these items and estimated your consumption, you will find that you have no rates to cover. At this point the most serious blunders have been made. Men have not had the courage to ask, as a matter of business common sense, for a remunerative rate. Too many times it has been a case of plain cold feet caused by inability or unwillingness to analyze the problem thoroughly and an additional lack of sales ability to tell the would-be customer what it all means in terms that he can understand.

The problem of financing is a difficult one, not merely because the rural service problem is new, but because just now almost any financing problem is difficult and a producer of gray hair for the unfortunate individual who must solve it. In some of the Eastern States the companies are financing the lines. In one case a rate of 20 per cent per year of the cost per customer is added to the rates covering the same service in the city territory as an excess cost charge. In Wisconsin, under the rules filed by several companies and approved by the commission, the farmer finances the extension and in addition to the regular city rates pays 10 per cent per annum plus the transformer-core losses at a fixed rate per kilowatt-hour as a rural charge for which he receives no energy. With allowances for interest on the investment this is approximately the same figure that the Eastern company referred to uses. Conditions have made this plan a necessity, but there are movements on foot that may subject it to serious attack. Permanent financing methods must be developed, but at the present time each utility must be governed by conditions.

An important factor in this service is the education of the farmer in the use of electricity. The manufacturer, the jobber and the dealer in electrical equipment must have a share in this, but the central-station company must be a leader because it is the first and last point of contact with the farmer. Take time to discuss the problem with the other members of the electrical industry in your territory and get them thinking straight, and then take it up with your farm equipment manufacturers and dealers. Get them interested in finding out how electric power may be best used on the farm and what adjustments in their present equipment must be made. Interest such farm papers as you can get to. You have information that they will be glad to get. If it comes from you, you will be in a strong position with them. Co-operate with your agricultural schools and through them reach their students.

PITFALLS TO BE AVOIDED

The first pitfall to be avoided is ownership and maintenance by the farmer. He does not and should not be expected to know the utility business. In most states, if forced to own and operate lines, mutual or actual utility companies, subject to the commission, must be formed. The growth of such companies would be parallel to the growth of the rural telephone companies. These companies form one of the most acute of our regulatory problems, and duplication of the problem in the electric service field, with the physical hazard due to the presence of the distribution voltages to be contended with, would be a calamity for the industry, not to mention the utility that might have such lines connected to its system. Utility ownership and responsibility for the lines involve difficulties, but they are of a moral character that can be solved. Regardless of the financing plan, the control of the lines must be in the hands of the utilities.

A most common error has been to build the lines and apply the city rate schedules. This is fatal. Some utilities in financing have forced the farmers to take company securities. In later customer-ownership campaigns it has been discovered that the farmers have looked on these securities as so much paper and on the money paid as the price of obtaining the service. In a market created by a real customer-ownership campaign these securities have been dumped with disastrous results.

Other companies have required the customer to advance money which is refunded later. If this is done without any strings as to revenue produced before the refunds are made, the utility is carrying the investment and must take account of the fact in its rate. Some have entirely overlooked the precaution. In general it is poor policy to mix rate schedules and financing.

THE RATE PROBLEM

In the present state of knowledge of the business it is unwise to attempt the establishment of a uniform system of rates over an entire system unless you are prepared to go into a long-drawn-out and extremely thorough study of the subject, and even then the results may not be worth the cost. It is well for the time being to take some set of rules, like that in use in Wisconsin, in which the fundamentals of costs are well covered and work out each case on its merits. This course involves more work, but the educational value of the plan is worth all that it costs and in the end will serve to prevent costly mistakes. Uniform rates on this business are probably not a safe thing to attempt, but a uniform method of computing rates for the individual extension is desirable and necessary if discrimination is to be avoided. For the present the Wisconsin method of adding the excess costs to the rate in the nearest town is desirable because it is anchored to a known quantity and is easiest to explain to the prospective customer. In the future I expect to see a rate with a fairly high fixed charge or rural-service charge, as it is more commonly called, with a very low energy rate, developed. Such a rate is psychologically correct because it brings home to the user the fact that he is buying a service. The low energy rate encourages him to use the service extensively because it is already paid for and the additional use is at small cost. This result will not be reached rapidly. There are too many things in the way, and established rates might be involved in an upset through a misunderstanding of the low rate as applied to rural service. The tendency would be to talk about the low energy rate and forget the fixed charges that actually bring the average rate to a much higher figure.

In the selection of line voltages do not make the mistake of selecting too low a voltage. Use lower voltages if you must to start with, but give yourself the utmost possible leeway in future increases with the minimum amount of reconstruction costs.

Above all, remember that you are selling service and not kilowatt-hours. Kilowatt-hours are a measure of that service. The price should no more be the same for all classes of service than the price of gold and lead should be assumed to be uniform because the weight of both is measured in pounds.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Attenuation of Line Current Essential for Radiation

To the Editors of the ELECTRICAL WORLD:

The proper interpretation of the declared potentials of Lorentz is so very important that any contribution to the subject should be welcomed. It is not clear, however, that Dr. Carson has clarified the problem of how radiation takes place by attacking the views of Dr. C. P. Steinmetz. (See *Proceedings A. I. E. E.*, October, 1921.)

It would seem that the former had proved his case by referring to the writings of Maxwell, Mie, etc., though Abraham of Göttingen and his ellipsoidal oscillator might also have been mentioned. If, then, "sauce for the goose is sauce for the gander," how does the mere fact that Lorentz expresses his "fundamental equations" in terms of a deferred system of potentials help matters along? At best, so far as Steinmetz is concerned, the question is wholly one of degree and not kind. Then what becomes of Maxwell himself in the light of the newer twist that is being given to Maxwell's theory?

The fact of the matter is that though the solution of the equation

$$\triangle \psi - \frac{1}{c^2} \frac{\delta^2 \psi}{\delta t^2} = 0$$

(see Lorentz, "The Theory of Electrons," Leipzig, 1916, page 6, equation 6), is typical "for a disturbance of the state of equilibrium, traveling onward with the speed c," another type of solution is also typical of a stationary wave disturbance which necessarily is not of itself to be considered as traveling *outward* in the same sense. The truth is that Maxwell's theory leads both to stationary waves (Maxwell's instantaneous potentials) and the progressive waves that Lorentz has in mind, which latter call for the Lorentzian deferred potentials. The two types are coexistential and not necessarily exclusive as the text has led some to believe.

In a yet unpublished contribution on the subject I have shown that on the basis of the Heaviside-Hertz fundamental equations attenuation of the line current is absolutely essential for radiation to take place. This is contrary to the view of Dr. Carson, yet it is a little difficult to understand why he should have imposed the condition that attenuation takes place suddenly and completely at the end of the line, when in fact at the end of the physical line it is open-ended. Surely it is a known fact that radiation takes place laterally along an open-ended Squier transmission line.

In the above paper, having set up a progressive wave of potential ("voltaic" effect) and of current ("galvanic" effect), attenuating to zero at the open end of the line, radial radiation perpendicular to the line is found to be set up. It is this effect that the older theorists with their four line constants, R, L, C, g, which alone cannot represent a physical line, have been looking for. The overlooked constants are those of my paper before the (British) Institution of Electrical Engineers, which appeared in April last. The treatment was along the lines indicated in my December, 1920, paper before the Institute of Radio Engineers, but based upon the mathematical and physical conceptions of the I. E. E. paper.

So far as the Poynting condition is concerned the condenser effect ("voltaic") of the one part of the circuit was assumed to be perpendicular to the wire and therefore at right angles to the magnetic ("galvanic") effect H due to the current flowing in the rest of the antenna, or transmission-line circuit. In the latter writing the basis of the assumed phase angle ψ of the I. R. E. paper was given.

A. PRESS.

Washington, D. C.

Better Illumination Cuts Production Costs

To the Editors of the ELECTRICAL WORLD:

A question has been brought up regarding the article entitled "Better Illumination Cuts Production Costs," printed on page 763, ELECTRICAL WORLD, Oct. 15, 1921, bearing on the fact that four of the twenty operations indicated decrease in production under the higher levels of illumination. This question is indeed pertinent, although we had endeavored to bring out in the article the reasons which, from our close study during the test period, seemed fully to account for these apparent decreases.

The four operations which indicated losses in production are confined either to the drilling or the tapping class. However, it will be seen from the table in the article that of a total of five drilling operations only two indicated losses, and that of four tapping operations again only two indicated losses. Considering that if all of the drilling operations are grouped together and if all of the tapping operations are grouped together, as in the following table, the gains in production more than offset the apparent losses, it does not appear logical to assume that the indicated decreases were due to too much light. Especially does this become evident when it is considered that all of the drilling and all of the tapping operations were of the same class, and only varied in the size of hole or size of iron, and were in some cases even performed on the same machines. The following tables indicate the average change in production for all of the drilling and tapping operations:

Factory Operation Number	Factory Operation	Change in Production, per Cent
1-21	Drilling	23
6-G-43	Drilling	—12
62-3	Drilling	24
72-3	Drilling	...
622-4	Drilling	—13
Average		4.4
1-33	Tapping	—12
6-G-44	Tapping	32
62-4	Tapping	24
922-4	Tapping	—11
Average		8.3

As the article emphasizes, the precision with which the data could be recorded and the variation in the run of material worked upon were such that it is dangerous to place too much weight on the exact percentage of gain or loss indicated for any one operation. For example, in the case of recording time, the time per operation in hours does not always refer to a continuous period, but rather in some cases it refers to a

summation of somewhat short intervals of time, that is intervals of three or four hours. It was only possible to record the time to the nearest half hour, and while it is obvious that a total period of operation built up from a number of short periods will tend to eliminate inaccuracies due to the mental and physical state of the operator, it is also true that conclusions as to the exact change in production of any one operation may easily be faulty owing to this inaccuracy in tabulating time. Of course, when all of the figures are averaged to obtain the change in production of the shop as a whole, many possible sources of error such as those due to recording time and to variations in material have a tendency to average out.

Frankly, we feel that these four operations which showed a loss strikingly bring out the point that unavoidable errors or inaccuracies are almost certain to be introduced to a greater or less degree in any investigation conducted in order to determine the effect of any one factor, such as illumination, on factory efficiency. In outlining an investigation provisions therefore should be made for following such a plan as will average out these possible discrepancies. The test should be conducted over a considerable length of time and with a comparatively large number of men working in the test area or on the test operation. A close check should be kept on the quality of material furnished the men. An accountant or efficiency engineer who is well enough acquainted with the work to check and weigh the various factors entering into such an investigation should supervise the test thoroughout the entire operating period.

O. F. HAAS,
Engineering Department.
National Lamp Works of General Electric Company,
Nela Park, Cleveland, Ohio.

Possible Errors Through Use of Line Data

To the Editors of the ELECTRICAL WORLD:

In the issue of Nov. 19 an article by W. S. Guthrie of the Anaconda Copper Mining Company dealt with the possible errors through use of line data. Inasmuch as this article might be interpreted by some as a warning against the use of some transmission-line calculation charts of mine which were published in the ELECTRICAL WORLD on May 28, I would appreciate your publishing the following remarks concerning Mr. Guthrie's statements:

The transmission-line calculation charts were developed for the purpose of allowing rapid calculations to be made of practical lines with very little labor. The text of the article with the chart says that in most cases the charts will give less than a 2 per cent error, and in very few cases is the error as great as 3 per cent.

An examination of Mr. Guthrie's calculation shows that the resistance value used is twice the resistance of one mile of No. 4/0 line; that is, the resistance of No. 4/0 per mile is approximately 0.266 ohm, instead of 0.53 ohm per mile. The calculation when carried through with the proper resistance value gives a drop of 80 volts per mile instead of 118 for the 2,200-volt line, and a drop of 85.8 volts per mile instead of 171.8 volts for the 173-volt line. By this method of calculation, then, there is a difference of 5.8 volts per mile in the drop with the two receiving voltages taken.

Even this small difference, however, would not occur in any practical case, because no engineer lays out a line with a 49.5 per cent voltage drop in one mile. To deliver the odd voltage of 173 volts over a No. 4/0 line with a load of 100 amp. at one mile distance, it is necessary to carry 258.8 volts at the generator. If we reduce the load or the distance to such a point that we get even the excessively large drop of 20 per cent, there is then a difference of 1.45 per cent between the values from Mr. Guthrie's calculation and the values from my charts. If we take a voltage drop of 10 per cent, which is the commonly accepted standard, there is a difference of 0.3 per cent between voltage as calculated by Mr. Guthrie's method and as taken from my transmission-line calculation charts.

The above examples are given simply for the purpose of showing that the charts are accurate within the limits stated and that it is safe to use them.

E. P. PECK,
General Superintendent Electrical Department.
Utica Gas & Electric Company, Utica, N. Y.

Switzerland's Hydro-Electric Plants Rated at 504,500 Kw. as of 1919

To the Editors of the ELECTRICAL WORLD:

The total energy available in 1914 in the whole of Switzerland was, according to a report of the Swiss Water Board, estimated at 4,000,000 hp., based upon an average of fifteen hours' working time at the power stations. Of this energy there was in use on Jan. 1, 1914, 500,000 hp. The new power stations erected and in course of construction from Jan. 1, 1914, up to Dec. 31, 1920, furnish about 300,000 hp., so that on Jan. 1, 1921, about 3,200,000 hp., four-fifths of the energy available, was still to be exploited. On Jan. 1, 1914, the total number of water-power stations was 6,860, of which 6,025, with an average total net capacity of 39,000 hp., had a minimum constant capacity of less than 20 hp.; 835, with an average total net capacity of 487,000 hp., a minimum constant capacity of 20 hp. and more, and only six a minimum constant capacity of 10,000 hp. and more.

The Swiss Electrotechnical Association has collected some figures regarding the situation at the end of the year 1919. The number of enterprises increased only from 1,185 to 1,285, nor has the number of places using electrical energy grown to any extent. This is due to the fact that there are scarcely any villages in Switzerland into which electricity had not already penetrated. With the exception of the population living in mountainous districts away from the road, it may be said that today electricity is at the disposal of all the inhabitants. In fact, Switzerland is declared to be the most completely electrified country in the world at the present time. The possible capacity of the hydro-electric power stations amounted in 1919 to 504,500 kw., with steam reserves of 66,500 kw. The electrical energy delivered in 1919 was 1,846,000,000 kw.-hr., of which steam plants produced 2,235,000 kw.-hr. These figures exclude the production of the Swiss Federal Railways and other producers which consume their own energy.

During the year 1921 the exports of electrical energy were as follows: To Germany, 36,610 kw.; to France, 24,296 kw., and to Italy, 46,859 kw., or a total of 107,765 kw. The total number of kilowatt-hours exported amounted in the year 1920 to 378,000,000, of which 221,000,000 were exported in the six-month period between April 1 and Sept. 30.

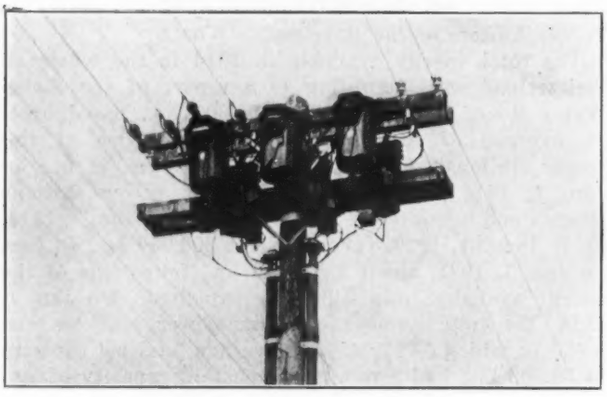
HENRY L. GEISSEL.
Thoune, Switzerland.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Econor. ical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Six Transformers Hung on One Pole Reduce Cost of Distribution

IN AN installation in southern California, where it was necessary to reduce the cost of a street-lighting installation to the minimum, it was found feasible to install six transformers on one pole, as shown in the accompanying cut. The transformers were 4-kva., type SL, 6.6-amp. to 6.6-amp., and were insulated for 10,000 volts. A saving of approximately 50 per cent was effected over installing these transformers on two separate poles. The reason they were all installed on one pole, other than the saving in cost, was that they feed six underground circuits. If the transformers had been on two poles, it would have been necessary to extend half the underground circuits one span.



CONCENTRATED TRANSFORMER INSTALLATION REDUCES STREET-LIGHTING COSTS

Southern California Edison Co., N. B. HINSON,
Los Angeles, Cal. Engineer of Distribution.

Radio Communication Between Power Stations and Substations

CONSIDERABLE attention is being directed to the utilization of radio communication between power stations and substations in Germany, according to a lecture recently delivered before the German Institution of Electrical Engineers at Hanover by Count Arco. Since with free radiation the power required increases approximately with the seventh power of the distance, more attention is being given to so-called "wired wireless." The transmission loss is less, and the atmospheric disturbance is practically nil compared with free radiation. Some trouble was experienced with line choke coils obstructing communication, but this difficulty has been overcome to a great extent.

Several radio installations for public utility service have been made by the German Company for Wireless Telegraphy, the most important being that at Golpa-Rummelsburg, with a transmitting radius of 135 km., and another at the Schichau works at Elbing rated at 50 km.

For supplying power to the cathode-tube generators a small battery is used to impress 10 volts across the incandescent filament, and another source of power, generally a rotary converter, impresses about 600 volts direct current on the anode. The cathode tube is connected up on Meissner's principle and delivers a constant amount of energy at a known amplitude and frequency. From this oscillating circuit the power is transmitted to the line, preferably on the Lecher system. This consists of two wires, about 100 m. long, which are mounted on the transmission line supports, and run parallel to the lines for a few meters. Both wires are coupled through a coil to the oscillating circuit of the generator. The efficiency of this kind of transmission is high when two wires are more closely coupled to two of the transmitting lines than to the rest. With the ordinary system of transmission lines this is easily possible. Thus there is very little free radiation, and most of the energy is communicated to the two transmission lines. A similar arrangement is used at the receiving end. The direct current is, if necessary, intensified by a low-frequency cathode tube and then transmitted to the telephone. It is specially necessary to see that at the receiving end there are no high harmonics superimposed on the direct current, as frequently happens with dynamos, commutators and brushes, and special arrangements must be made with this object in view. By using different transmitting wave lengths at the two ends it is possible for both persons to speak at the same time, and this has undoubted advantages. The difference in wave length must be fairly considerable. Any disturbance due to such a cause can be obviated by the use of a tuned choke-coil circuit. The wave lengths cause certain complications if there are a number of substations; but it is possible to deal with this by automatic apparatus. Modern cathode tubes have a very high vacuum and give constant results if the auxiliary apparatus is kept in good order. Slight changes may be due to alterations in the dielectric, but the factor of safety is so high that this produces very little result. With this directional telephony the intensity at the receiving end is very high; therefore, if a simple rectifier is used, it is possible to employ an ordinary moving-coil instrument or a polarized relay of high sensitiveness to operate the local bell circuit.

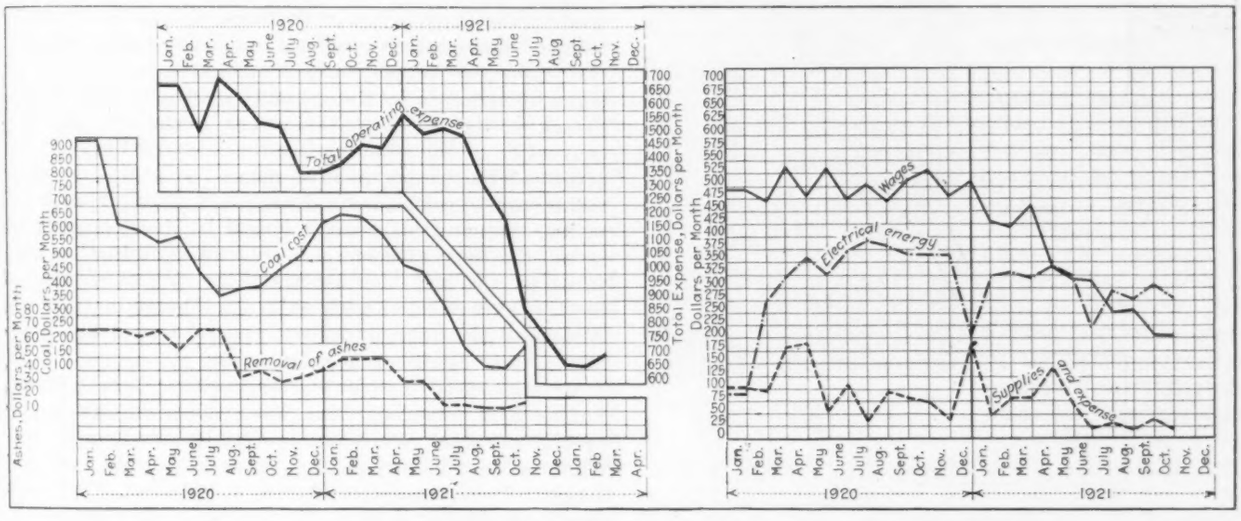
Special apparatus has been developed for communicating when the lines are completely severed. This apparatus may be obtained in portable form and is small enough to be carried by hand or in a motor car. It involves an emergency antenna like that ordinarily employed for free radiation.

Apparatus has usually been designed for stations of a given size, so that in passing from one size to the next there is generally a considerable difference in cost. In the cost of maintenance the expense of new tubes is the greatest item. The main thing is only to use the

tubes when they are wanted and to get tubes that have the longest possible life. The lives of tubes have been much improved of late, and further improvements are likely. If they are kept at a low temperature, the life is correspondingly improved. No doubt the tubes are then less efficient, but the cost of a little extra energy is not so great as the cost of the new tube. Usually the cost of radio is prohibitive, compared with wired telephony, when the distance between stations is less than 20 km., owing to the investment required in apparatus.

Central-Station Service Halves Hotel's Power Costs

IT IS coming to be a well-recognized fact that in the vast majority of cases the cost of purchasing central-station energy is considerably less than the cost of generating power in a small individual plant. An interesting example giving concrete figures in proof of this statement is that of the change-over from an isolated power plant to the use of central-station energy by the Hotel Stenton, Philadelphia. In this hotel the expenses for heat and power have been reduced practically 50 per cent by shutting down the power plant and adopting the various equipment to the use of purchased electricity.



OPERATING EXPENSES HAVE DROPPED TO HALF SINCE CENTRAL-STATION POWER WAS ADOPTED

Concretely stated, the total operating cost averaged $1,525 per month during August, September ond October, 1920. During the same three months of the year 1921 it was $712 less per month. This saving was made at a total cost of $6,251.38 for all the improvements to light, heat and power equipment.

Among the most important changes are the substitution of an electric elevator for the old-type hydraulic one and the substitution of centrifugal pumps for house water service, boiler feed, heating return, etc.

In the new installation the electric elevator requires 7½-hp. motor, the ice machine requires 12 hp., and the motors for driving the centrifugal pumps are rated one at 5 hp., two at 2 hp. and one at ¾ hp. The plant formerly had two 80-hp. boilers operated at 90 lb. to 100 lb. pressure. The only boiler required now is for low-pressure steam used in heating. This is an 80-hp. boiler operating at about 20 lb. pressure.

In examining the curves showing the costs of various items it should be borne in mind that these changes were not started until March and April of this year and were not fully completed until August, at which time the labor cost was brought down to the final minimum. Except in the month of January, 1920, this plant was making use of purchased energy for its lighting requirements, at the same time running various pumps, elevators, etc., by means of high-pressure steam. Savings in this case are therefore due largely to the fact that high-pressure steam was done away with in such a manner as to insure all of the economies possible through the low-pressure steam and purchased electricity system.

Special attention should be called to the fact that the new system of operation precludes much of the waste incurred in private-plant operation. The reduction in operating costs is self-guarded, being in many cases under automatic mechanical control, free from errors of human attendance. With two men the plant is now operated at higher efficiency than formerly when it required four or five men to maintain the high-pressure steam. These men were also furnished meals, the expense for which has not been included in the figures submitted.

It will be noticed that the cost of purchased electricity has not shown a material increase. The reason for this is that the rate under which the energy is being purchased at the present time has been changed so that, although more energy is required, the total cost is no greater than it was previously. This is due to the fact that the previous service was in the nature of a breakdown service, and the rate was very much higher in proportion to the energy used. Thus under present conditions, where the rate is properly chosen to meet the demands of the hotel in the most economical manner, the total cost is not materially increased.

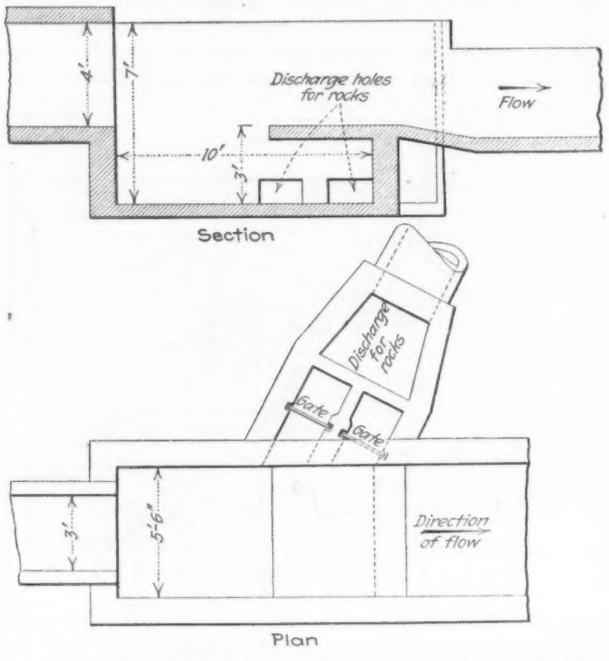
Credit must be given to Arthur F. Heeb, manager of the Hotel Stenton, for the completeness of the operating data which are available. Moreover, it is the thorough and efficient manner of operation of the equipment which is largely responsible for the excellent economies shown.

J. KEARSLEY M. HARRISON,
Harrison & Company, Engineer.
Philadelphia, Pa.

Rock-Drop Prevents Rocks and Gravel Entering Flume Line

AS SAND boxes have not always proved effective, the Southern California Edison Company has designed a rock-drop which is installed between the intakes and the sand boxes of its smaller hydro-electric stations to catch the great quantities of small rocks and sand entering the intakes of the plants taking their water from mountain streams subject to floods and flowing at high velocities.

At a suitable point in the canal line the rock-drop is placed so that water may be discharged from it without danger of causing washes. As shown in the illustration, these rock-drops are simply boxes built into a concrete section of the canal line and equipped with gates which



SHELF PREVENTS ROCKS TRAVELING ON DOWN THE FLUME

may be opened intermittently or kept open when the streams are at flood. As the velocity of the water in the canal line is low, almost all of the rocks drop into the box and are washed out by opening the gate. Rocks can be sluiced out of the rock-drops by the use of much less water than is lost in emptying the sand boxes, which are usually quite large. During floods the gates of the rock-drops are left open, as at such times there is a surplus of water.

J. W. ANDREE,
Assistant Superintendent of Generation.
Southern California Edison Company,
Los Angeles, Cal.

Iowa Utilities Developing Old Mill Sites

THE utilization of old mill dams by power companies is an interesting electrical development of Iowa. In the fifties, sixties and seventies, when Iowa was frontier territory and there were few railroads in the state, every river and stream had its grist and flour mills. Most of these long ago closed their doors; some are still running as feed mills; a few are still real flour mills, though without the prestige of bygone days. Within the last fifteen years power companies have been giving more and more attention to these old-time power plants and in many instances have taken them over. A good illustration is the Northeastern Iowa Power Company of Clermont, Iowa. By the installation of modern machinery this company has been successful in developing and improving such water powers so that maximum power is obtained from a minimum amount of water. As it has added more power it has gradually extended its lines, until now it has more than 200 miles of transmission lines and is serving towns and villages and many farms in five different Iowa counties. Some of the farms are the same ones which in early days used to depend on the mills to grind their grist for them. The Northeastern Iowa Power Company has an interchange connection with the Citizens' Gas & Electric Company of Waterloo, Iowa.

Special Types of Lamps Improved During Last Year

MARKED advances in the application of lighting equipment to commercial purposes, coupled with a wider recognition of the importance of individual treatment of illumination problems and development of special types of lamps, were emphasized as the chief signs of progress by the committee on progress, which presented its report at the recent Rochester (N. Y.) convention of the Illuminating Engineering Society. In seventy-three closely printed pages the year's developments are chronicled succinctly and with breadth of vision. General progress, followed by developments in street lighting, exterior and interior illumination, fixtures, physics and other aspects of the subject of modern lighting, are treated with skill and discrimination. A résumé of the more important general and street-lighting matters discussed is given below.

Developments in light sources have not been marked, but notable advances have been made in lamps for special purposes, including projection, automobile and sign lamps, motion-picture apparatus and miners' lamps. For stereopticon work a 300-watt, 28-32-volt gas-filled lamp in a short tubular bulb has been listed. It is announced that in Germany a new high-current arc lamp for motion-picture projection has been successfully produced, in which the upper carbon is horizontal and the lower is inclined at about 60 deg. from the horizontal. Formerly it was difficult to keep the arc steady above 30 amp., but the new lamp is reported to work satisfactorily up to 80 amp. on both direct and alternating current, through magnetic control of the arc. Simplified mechanism is a feature, and only two hand adjustments are required on this development as now introduced into America.

An improvement in the Beck type of high-intensity arc lamp for projection work is obtained by using greater currents with smaller carbons of the cored type, in which the metal fluorides are replaced by oxides. The area of the carbons is reduced to about 20 per cent of that of the ordinary type, with a resultant electrode brightness of 1,260 candles per square millimeter. By using a magnetic field the current density in United States Army searchlamps was increased from 0.15 amps. per square millimeter to 0.35 amps., with an increase of 50 per cent in the total luminous flux. An improved French stereopticon lamp is also reported for opaque projection, this outfit having reflectors behind the source of light and short-focus lenses for concentration. In a new miner's lamp improved fittings and well-distributed weight are features.

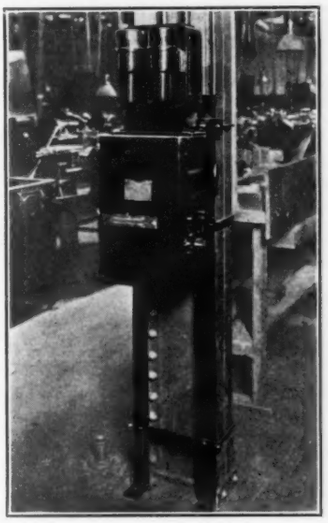
Simplification of the quartz burner has been achieved in mercury-vapor lamp design through the development of a means of connecting quartz through intermediate steps of glasses of increasing coefficients of expansion to a glass fused directly to a metal lead-in wire and forming with it a permanent vacuum-tight seal capable of withstanding high temperatures. This has made it possible to use an anode electrode of infusible tungsten instead of mercury, and the lamp does not require the former elaborate cooling devices. A neon-vapor lamp rated at ¼ cp., 110 volts and upward on alternating-current supply and 150 volts and upward on direct-current and consuming 5 watts has been introduced into England as a night light. The claimed life is over 1,000 hours. Neon lamps with automatic starting features, with a claimed energy consumption of 0.5 watt per candlepower, are being made in Germany. In addition to emergency and long-hour uses, it is suggested that these units be utilized to indicate switch positions, fuse openings, motor-service continuity, etc., through parallel connection. Researches on the production of low-voltage arcs in a mercury-vapor atmosphere indicate a linear relation between striking voltage and current through the cathode for the larger currents. With tungsten cathodes 3.2 volts was noted as a minimum striking potential compared with 4.9 volts with lime-coated platinum cathodes.

It is expected that 1921 will see the virtual elimination of the carbon-filament lamp in American manufacture. Gas-filled tungsten lamps represented 20 per cent of all tungsten lamps disposed of in 1920 as against 19 per cent in 1919 and 13.7 per cent in 1918. The use of carbon-filament lamps increased in Germany about 5 per cent from 1918 to 1920. In this country the average candlepower, watts and efficiency all show an increase due to the greater proportion of gas-filled lamps used. The effort here to standardize at 110, 115 and 125 volts is progressing, 80 per cent of the present demand being for these voltages, while of 481 central-station companies 96 per cent are using these voltages exclusively, as against 79 per cent in 1920. New lamps have been reported in the street series, stereopticon and sign classes. For the first-mentioned a 2,500-cp., 20-amp. unit has been made available, and this constitutes the highest candlepower source in this type. The current is derived from a compensator or transformer from regular alternating-current series circuits. A decided advance in the sign-lighting field is recorded in the advent by the production of 25-watt and 50-watt, 110-125-volt vacuum lamps in short pear-shaped bluish-colored bulbs with the filament in a plane perpendicular to the lamp axis. This gives maximum candlepower in the direction of the tip, and the lamps are rugged and compact. Double and three-filament lamps of the gas-filled type have also been developed for automobile headlight service within the year. For automobile lamps voltage conditions in service have been studied, and as a result changes will be made which it is expected will result in increased efficiency and brilliancy.

Instead of by the so-called "useful life" performance, lamp service is this year evaluated in terms of average total life and mean efficiency during life, or on the basis of the average total life corrected to a stipulated mean efficiency during total life. Except as a primary standard, candlepower rating has been abandoned and all light measurements are expressed in lumens. Last January the lumen and lumens per watt were adopted by the larger lamp manufacturers as the official units in which to express the light output and efficiency of their product. A movement is afoot to label street series lamps in lumens, the candlepower rating being also printed to avoid conflict. It is hoped to have contracts changed so that the lumen rating will be specified.

Standardized Compensator Mounting on Steel Columns

TO MAKE relocations of compensators easy and inexpensive and to support these equipments in minimum space, their mounting on steel columns at the factory of the American Bosch Magneto Corporation of Springfield, Mass., has been standardized by the electrical department as shown in the accompanying photograph.



COMPACT AND EASILY MOVED COMPENSATOR MOUNTING

The compensator is mounted on two vertical pieces of 2½-in. x ½-in. strap-iron bent at right angles at their lower ends to form floor pieces. They are clamped to the column near the floor by ⅜-in. tie rods bolted through a 1-in. x ⅜-in. horizontal strap. Behind the compensator case they are bolted to two straps, ½ in. x 2½ in. in section. The lead wires are carried above the compensator in vertical rigid conduit. The tie rods are bent around the inner edges of the column, forming hooks of convenient shape for a secure clamping effect. The use of narrow straps in these supports, with a U-shaped 1¼-in. x ⅛-in. strap behind the compensator case for direct attachment to the horizontal pieces, results in unusual economy of space, the equipment being practically flush with the column and forming little or no obstruction to free movement through aisles. LEO KRESSER.

American Bosch Magneto Corporation,
Springfield, Mass.

Signal Light Indicates When Rotary Brushes Are Raised

IN ORDER to give an indication to the operator of the position of the brushes on two rotary converters recently installed in a San Francisco substation, a switch has been placed on the frame of the machine and connected to the brush-lifting arm so that the circuit is closed when the brushes are down. This switch controls a lamp placed on the switchboard. If the lamp is lighted when the machine is being started, this is an indication to the operator that the brushes are down on the commutator and that they should be lifted. The switch used is an inclosed one such as is used on elevator doors to operate the control circuit. This type of switch was selected because in case of a flash on the commutator the switch housing would protect it against damage by fire. This information was contributed by J. E. Woodbridge, engineer for Ford, Bacon & Davis. FIELD EDITOR ELECTRICAL WORLD.

San Francisco, Cal.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

Progress of Electric Service in the South

In a Recent Letter, W. E. Clement, Commercial Manager of the New Orleans Railway & Light Company, Tells of Electrical Development in the South

IN THE older cities of the South there has been up to recently a large percentage of unwired homes. A number of these were among the better class of residences built long before the use of electricity became general, and the owners have been reluctant to put up with the inconvenience of having the houses wired while occupied. Where the wiring had already been done there was a great lack of convenience outlets. During the past few years, however, an interesting development has occurred in that a very considerable number of these large old Southern homes have been remodeled into apartment dwellings and properly wired in connection with the remodeling work. This condition has, of course, meant much new business where the electric service lines were already established.

W. E. CLEMENT

Electric appliances also have become a vital necessity on account of the high wages of servants and the newly experienced difficulty in obtaining help. The general prosperity of the past few years has also raised the standard of living among our laboring classes, so that today virtually every family, including even the negro population and excepting only the very poor, regards electricity as a necessity and not as a luxury. Electric appliances, even washing machines, are now in general use. The summer fan load has grown by leaps and bounds. Formerly one fan in a household was a luxury to be carried around from room to room. Now the tendency is to have a fan in each room in the house and to make very liberal use of it for long-hour operation.

The principal new development in the industrial load throughout the South during the past few years has been raw-water ice plants. In New Orleans we have added six such plants to our lines, ranging in capacity from 60 tons to 300 tons of ice per day. All the new plants are operating satisfactorily, and the indications are that electrically driven raw-water ice plants will gradually supplant the old types. This business offers a new type of load that is very attractive to the central-station company as it is off-peak; moreover, the consumption is heavy in summer and light in winter and results in a very distinct improvement in the yearly station load factor.

Another interesting development has been the use of electric power in harbor work. While this applies particularly to New Orleans, it applies also in a general way to a number of the Southern ports. About eighteen years ago a survey was made of the city of New Orleans from an electrical standpoint, and the possibilities for the use of electric power for loading and unloading ships in port was pointed out. While at that time we could not visualize this idea to any extent, it has now been realized.

During the past four or five years the immense public grain elevators and cotton warehouses have been erected on the river front, an inland waterway system is nearing completion, and remarkable developments in the revival of the river traffic are taking place. Central-station energy is used exclusively in connection with this terminal work and is reaching a total beyond all expectations of only a few years ago.

One Good Reason for Investing in Public Utility Stocks

UNDER the heading "You and Your Money" a sound argument in favor of investment in public utility securities is presented by the Consumers' Power Company of Jackson, Mich. Pointing to bankers' methods of investment, the statement reads:

"The national banks of the United States invested 40 per cent more of their funds in public utility securities in 1920 than in 1919. These banks know—the facts which guide their judgment should guide you in your personal savings.

"Are you getting the most out of your money? Do you get only 3 per cent or maybe 5 per cent? A percentage of 7.37 is more than double 3 per cent and it is 47 per cent more than 5 per cent. When it earns you such small figures in a bank that money is reinvested in the very security that you yourself can buy. Fifteen hundred and forty-eight Consumers' Power employees have invested in their company's preferred stock, which returns 7.37 per cent on the investment.

"Why not get the full profit your money will earn, right at the source?"

Starting New Customers Off with Right Impressions of the Company

FIRST impressions are lasting and whenever a new application for service is accepted by the Edison Sault Electric Company of Sault Ste. Marie, Mich., the accompanying letter sent to the new customer has proved valuable in promoting friendly relations between the customer and the company. "It is our aim," says Edward Horry, vice-president and general manager, "to impress upon the customer the fact that we want him to come to us at any time for advice or with any complaint that he might have rather than go to somebody

else and tell his troubles, which might be exaggerated as they were passed along."

DEAR SIR: It is with a great deal of pleasure that your application for electric service has been accepted by this company. It is our desire to go beyond the definite terms of our contract with you in the matter of service. We view our business relations with a new customer as only just beginning when meter and service installations have been made, and they do not end with the payment of bills as we are eager that the service we may have the privilege of rendering be real and lasting.

We have in connection with our office a salesroom, where we carry a complete stock of bureau tested lamps and household labor saving devices such as irons, toasters, percolators, washing and ironing machines, which we will be only too glad to demonstrate to you and tell you how cheaply they can be operated and the vast amount of real drudgery they take off the shoulders of the housewife.

We hope to deserve your further patronage and good will, and trust you will immediately notify us of any failure on our part to render you excellent service.

EDISON SAULT ELECTRIC COMPANY.

The Utility's Opportunity in Observing National Holidays

HOW a public utility can use its display windows in the observance of great national holidays is shown here in the two pictures of the windows of the Utica (N. Y.) Gas & Electric Company during the week of Nov. 7, the display being in keeping with the spirit of Armistice Day. In this impressive exhibit the company's honor roll, the Statue of Liberty and a bronze statue of the "Doughboy" were featured in one window, and in the other a photograph of the President of the United States together with photographs of Generals Pershing, Foch and Diaz were grouped and draped with the national colors.

"The local Armistice Day celebration," says Commercial Manager W. J. Reagan, "was accentuated, especially among the foreign-born population, by a visit from General Diaz, the noted Italian patriot. Appreciative comment on the windows was made by his former countrymen as well as by many prominent citizens who have interested themselves in the local Americanization work.

"Quantities of ferns, flags and tulle in red, white and blue added greatly to the attractiveness of the windows. By virtue of their appropriate nature and unusual merit the displays were greatly admired and many complimentary remarks were heard.

"The windows of the office building of a public utility may thus be used to promulgate the patriotic idea perhaps to greater advantage than any other commercial agency. Previously, the banks have reminded us of the advent of the holiday or patriotic occasion, but a much stronger appeal can be made through a constructive and well-arranged window demonstration."

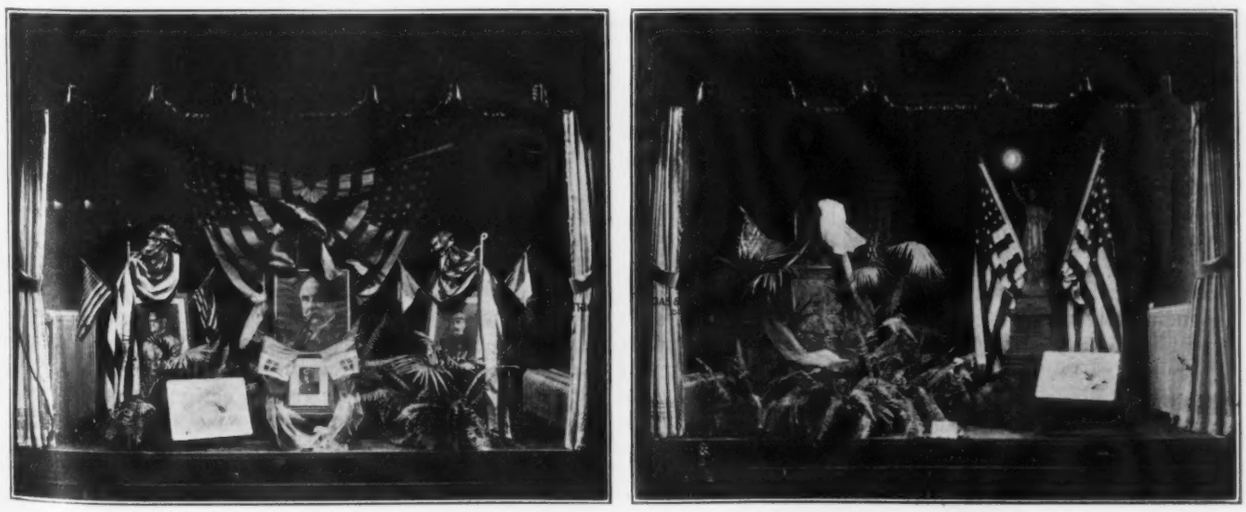
What Other Companies Are Doing

Lebanon, N. H.—Thirty electric ranges have been sold this year in the territory served by the Grafton County Light & Power Company of this town. A rural population aggregating about 9,000 is scattered along the company's lines. H. M. Tucker is manager of the company.

Chicago, Ill.—The Commonwealth Edison Company is offering new stock to stockholders of record Dec. 17 to the extent of 8 per cent of their holdings at par, payable in four instalments of 25 per cent each. Commonwealth Edison has around 27,000 stockholders, compared with 5,700 when the armistice was signed. Since the customer ownership campaign started the stock has advanced from 103 to 115. Most new stockholders were secured by solicitation of employees.

Worcester, Mass.—The New England Power Company is completing a one-story power house of brick and concrete fireproof construction on the Deerfield River at Searsburg, Vt. The company is also having an earthen dam and penstock constructed. The Aberthaw Construction Company, Boston, Mass., is the contractor.

Portland, Ore.—The electrical contractors and dealers of this city in co-operation with the light and power companies serving Portland and vicinity, launched an active electric range campaign early in November. A price slightly above cost was agreed upon on all types of ranges and a flat price to cover the inside wiring was made and prices quoted on ranges installed either with or without inside wiring. A feature of the campaign is the sale of the ranges installed complete, including inside wiring on a deferred-payment plan. The underlying scheme of the campaign is that the power companies buy the ranges in large quantities, the dealers receiving them on consignment and being paid a commission on each sale. Co-operative advertising is carried on in the local newspapers.



AN EXCELLENT EXAMPLE OF THE TIMELY OBSERVANCE OF A NATIONAL HOLIDAY

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

"Double-Step" Motor.—A. STOMMEL.—The author suggests a new type of induction motor which would permit a great many useful variations as motor, generator, regulator and frequency changer. For example, a three-phase induction motor with wound armature may be connected to the line so as to feed both stator and rotor from the line at the same time. The result will be a motor with a speed equal to the difference of the speeds of the two rotating magnetic fields. Stator and rotor winding may then be designed so as to divide their load either equally or so as to give one winding the total power output and the other winding only the second field. As in the case of the direct-current motor, such a "double-step" motor can be connected as a series, shunt or compound machine. Combining two such machines mechanically on one shaft results in a frequency-changer set, or, as the author calls it, a frequency splitter. As the mechanical couplings may permit a change of the relative position between the two armatures, all frequencies from zero to line frequency may be obtained stepless.—*Elektrotechnische Zeitschrift*, Nov. 10, 1921.

A Simple Method of Finding Steam Consumption of Small Turbines.—Small turbines using superheated steam frequently have a superheated exhaust. This paper shows that in such a case the water rate of the turbine may be determined by simple temperature and pressure measurements at inlet and exhaust.—*Power*, Dec. 6, 1921.

General Specification of Alternating-Current Motors for Main-Roll Drive.—These specifications are intended to cover as far as possible the general requirements for main-roll motors in steel mills and are issued by the American Iron and Steel Electrical Engineers, to be furnished to electrical manufacturers. They represent the consensus of opinion of a large majority of users and designers of such motors. They are for use when mills are to be electrified.—*Bulletin of the Association of Iron and Steel Electrical Engineers.*

Generation, Transmission and Distribution

Asynchronous and Synchronous Generating Plants for Small Watersheds.—H. KYSER.—From an economical standpoint it is very desirable to have a number of small hydro-electric plants tie in with a large steam plant. In such a case it is best to have the hydro-electric plants supply the average load while the steam station covers the peaks. It has recently been a much-discussed question whether these small plants should be equipped with asynchronous or with synchronous generators. The respective features of the two systems may be briefly described as follows: (1) The asynchronous generator is operative only with impressed voltage from the main plant. Frequency, load and voltage are regulated from the main plant, so that no turbine regulator is necessary. To avoid run-away at no load, a speed limit must be installed. The generator may be operated with minimum of attention. Efficiency, floor space, weight and cost are lower than with a synchronous generator. Power factor, while the same at full load, falls rapidly with load. (2) The synchronous generator operates only with independent direct current supply (exciter). The driving of the exciter by belt from the main generator is dangerous. Very exact turbine regulation is needed. High and elastic power factor is obtained. To make a definitive decision for one or the other system, the following points require careful investigation: (1) Reaction on the main plant; (2) load conditions in the tie-in plant; (3) economy; (4) independence of the tie-in plant. The very elaborate article discusses all these points in general and by means of concrete examples, coming to the conclusion that, except in very rare cases, the asynchronous generator does not give technical or economical advantages over the synchronous type.—*Elektrotechnik und Maschinenbau*, Oct. 30 and Nov. 6, 1921.

Electrical Supply in Sheffield, England.—Details of the new Blackburn Meadows station, including the boiler room, the turbine room, switchboard, cooling plant, etc. —London *Electrician*, Nov. 4, 1921.

Burning Pulverized Anthracite Mine Waste.—O. M. RAU.—Results of tests obtained by burning pulverized anthracite coal in the Philadelphia Rapid Transit Company's power plant, where pulverizing equipment is installed for ten boilers though only one boiler has been in operation to date. An efficiency of 62.2 per cent for boiler and furnace was obtained, and it is expected that this will be raised to 76 per cent when improvements and changes suggested by the preliminary operation have been made.—*Electric Railway Journal*, Nov. 26, 1921.

Developments in Power-Station Design.—A continuation of a series on recent progress made in developing equipment used in power stations. The present article deals with stokers and various methods of removing ashes. One ash remover mentioned maintains an air-sealed combustion chamber, quenches the ashes as they fall from the furnace, prevents dust, fumes and heat from reaching the ash tunnels and does not necessitate building the boilers above the ground level. Another scheme makes use of a stream of continuously flowing water for delivering the ashes into a sump.—London *Engineer*, Nov. 18, 1921.

Electrolytic Protection of Steam Boilers Against Scale and Corrosion.—W. PHILIPPI.—A description of a method said to be successful in protecting steam boilers against their two greatest enemies, corrosion and boiler scale. Careful investigations of corrosion on boiler bottoms, water tubes and condensers proved, the author says, that electrolytic action was the cause of these damages. As a remedy a metal of higher emf., like zinc, has been connected electrically to the boiler to create a counter-emf. to compensate for the corrosive current. But this method did not always give complete

satisfaction, as it was impossible to regulate the current. An externally generated direct current, applied through electrodes into the boiler, was found to be a perfect remedy. In fact, by doing this the small but constant generation of hydrogen along the boiler walls will also effectively prevent the formation of boiler scale. A direct-current voltage of from 10 to 20, at a current density of about 2 milliamperes per square foot, was found to be most effective. A small motor-generator of 6 kw. may supply a battery of thirteen boilers, each of which may have four protective electrodes. A small resistor in series with each electrode circuit permits of suitable regulation of the voltage. Ordinary wrought-iron gas pipes are used as electrodes. Experience with this protection, extending now over several years, surpassed all expectations. On boats using sea water in the condensers no corrosion of any kind was observed after months of operation, while before installing the electrolytic protection it was necessary to clean them every few weeks.—*Siemens Zeitschrift*, October, 1921.

Essential Qualities of Oil for Steam Turbine Lubrication.—J. Y. DAHLSTRAND.—This article states that the price of lubricant is the least important of all considerations as savings may be lost many times in repairs to machinery. Flash test and specific gravity are considered of little value. Recommendations by machinery manufacturers for lubricants are given.—*Electrical Review*, Nov. 19, 1921.

Hydro-Electric Works in New Zealand.—This article speaks of the allocation by the government of New Zealand of the sum of seven million pounds for the development of the colony's hitherto little-exploited but admittedly valuable hydro-electric power. The project includes the construction of a number of dams, the acquisition of latest types of plants and machinery, substations and secondary lines.—*Electrical Industries*, Nov. 9, 1921.

Lamps and Lighting

Day and Night Lighting in Textile Mills.—SAMUEL G. HIBBEN.—Intensities of lighting desired, arrangements of units and suggestions for proper maintenance are given in this paper. The variation of daylight throughout the day is shown by curves.—*Electric Journal*, November, 1921.

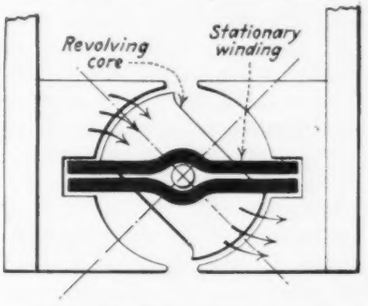
Traction

Trackless Trolleys Instead of Street Railways.—M. SCHIEMANN.—The trend in every large city has long been to establish a quick and modern transit system from the business center to the residential sections. In the majority of cases it would be possible to install a trackless trolley system over existing well-kept-up roads with a minimum of invested capital and a maintenance cost about equal to that of a street railway. For ten years such a system had been in operation between Hamburg and Marienhöhe, but it had to be abandoned in 1917 on account of the conditions brought about by the war. The run was 2½ km. each way, and the cars weighed 3,150 kg. and could carry twelve seated and ten standing passengers. The wheels had solid rubber tires and were driven by one 15-hp. motor with a silent worm drive. The trolley was pivoted on the roof of the car in such a manner as to give a free sway through a full circle, permitting the car to deviate as much as 3 m. from its route. A "pay-as-you-enter" fare-collecting system was in use. For the trackless trolley system in general the author makes the following claims: (1) Operating cost, including interest, depreciation and renewals, per transported passenger is the same as for rail traction; (2) the building cost is at least three times higher for a street railway; (3) the wear and tear on the road is less with the trackless system; (4) the traffic obstruction is far less.—*Elektrische Kraftbetriebe und Bahnen*, Nov. 10, 1921.

Ten Years Operation of the Hamburg Elevated Railway.—DR. ING. WILHELM MATTERSDORFF.—An account of the many changes of an economic nature which have occurred to this property since it was put in operation in 1912. General statistics are given, together with a list of improvements which have been made.—*Electric Railway Journal*, Dec. 3, 1921.

Installations, Systems and Appliances

Magneto and Alternator Type "Stella."—H. TOURNAYRE.—A magneto is described in which the magnet and the winding are stationary. Pulsating magnetic flux is established within the winding by a swinging or rotating soft-iron piece, shaped like the familiar Siemens double-T armature. A complete flux reversal takes place after each quarter revolution. Such a magneto, weighing only about 10 ounces, can produce 4 watts at 6,000 r.p.m. with 75 per cent efficiency. The same principle could be used advantageously on large machines, and especially on high-frequency generators.—*Revue Générale de l'Electricité*, Nov. 12, 1921.



WINDING OF MAGNETO REMAINS STILL WHILE CORE REVOLVES

The Future of Electrically Driven Rolling Mills.—L. ROTHERA.—This paper states that motor drive continues to grow in favor for rolling mills and that no instance is known of a motor having been replaced by another form of drive for such work. Practice has shown that the claims made for electric drive on the score of economy, efficiency, low upkeep, flexibility and reliability are fully justified.—London *Electrician*, Nov. 18, 1921.

Electric Furnace in Melting and Refining.—JOHN B. C. KERSHAW.—A discussion of the poor progress made in England during the last year in adopting the electric furnace for melting and refining and of the modern tendencies in the design of electric furnaces. Tilting and rocking arrangements, electrode operating gears and electrode economizers are also described.—London *Electrician*, Nov. 18, 1921.

Electrochemistry and Batteries

Electrolytic Solution and Deposition of Copper.—T. R. BRIGGS.—The author modifies the theory formulated by Luther and concludes that the electrolytic behavior of copper in solutions containing copper ions may be accounted for by two electrochemical reactions or their reverse. The theory advanced is applicable in general to metals other than copper.—Paper presented before Electrochemical Society, Oct. 1, 1921.

Telegraphy, Telephony and Signals

Carrier-Wave Multiple Telegraphy and Telephony.—K. W. WAGNER.—The author gives a review of the fundamentals of carrier-wave multiplex, illustrated with diagrams and photos showing the latest developments of this art in Germany. The Germans have devoted a good deal of energy to the application of carriers to rapid telegraphy and have succeeded in bringing the multiplexing of machine telegraphy to a fair degree of reliability. On a 600-km. telephone line from Berlin to Frankfurt six telegraph channels have been superimposed and are used for six Siemens printers, the total capacity of the line, besides ordinary telephony, being 3,000 letters a minute, or about 3,600 ten-word dispatches an hour. The carrier impulses are sent by a grid relay, and the received signals are amplified in four double-grid tubes. Two rectifying double-grid tubes operate a double-pole relay which controls the printer. Carrier-wave telephony over high-tension transmission lines is briefly mentioned.—*Teknisk Tidskrift, Elektroteknik,* September, October and November, 1921.

Large Radio-Telegraphy Stations in the Dutch East Indies.—A description of the large radio station in Java which has nearing completion an arc-lamp transmitter rated at 2,400 kw. to 3,600 kw. The aërial is suspended across a valley between two mountain peaks. The transmitting station is from three and a half to four times as powerful as the largest European stations such as that at Bordeaux, etc. This station is being constructed for the purpose of transmitting messages from Java to Holland, a distance of 1,200 km.—*Radio Review,* November, 1921.

Operation of the Modulator Tube in Radio-Telephone Sets.—E. S. PURINGTON.—In radio-telephone transmitter circuits using electron tubes the radiated power is caused to vary at speech frequencies usually by one of the three following methods: First, by variable absorption of the output power of a radio generator, as by a microphone in the antenna circuit; or, second, by varying at speech frequencies the operating grid voltage of a radio generator, as in grid modulation; or, third, by varying at speech frequencies the input plate voltage of a radio generator, as in plate modulation. The third method is used in practically all commercial and military types of apparatus. It is superior to the others with respect to the intensity of signal conveyed for a given total input power, and with respect to inherent reliability and tone quality. This paper deals with phenomena in transmitters of this third type.—*Scientific Paper of Bureau of Standards, No.* 423.

Miscellaneous

Electric Arc Welding for Boiler Repairs.—A report of the best methods of reconditioning boilers by means of electric welding. For a good weld the operator must have a certain skill and experience, the electrodes must be of proper material and the work must be correctly prepared. Details of methods for treating various parts of boilers are given, and these are explained fully with numerous illustrations. Among the topics covered are fire boxes, patching side and door sheet, fire-box sheet-knuckle patches, preparing small portions of side sheets, welding patches on front of crown sheets, welding seams, broken mud ring, door-collar patch, flues, etc. A tabulation shows that the cost of labor for applying electric welding to a three-piece Micado fire box is about $106, against $120 for riveting a firebox.—*Railway Electrical Engineer,* November, 1921.

Survey of Elevator Interlocks and an Analysis of Elevator Accidents.—C. E. OAKES and J. A. DICKINSON.—This report gives the results of a field survey of several thousand elevator landings equipped with different types of interlocks. The survey was conducted in connection with the preparation of an elevator safety code, in which work the Bureau of Standards has co-operated with the American Society of Mechanical Engineers. Statistics show that 73.8 per cent of all fatal accidents might be prevented by well-designed interlocks.—*Technologic Papers of the Bureau of Standards,* No. 202.

Use of Electric Power on the Western Front.—MAJOR T. RICH.—A lecture dealing with the work of the American, French and German forces in the recent war. With the exception perhaps of Germany, all the nations began by using direct current, but as the war progressed the advantages of the three-phase system became so apparent that it was being used exclusively at the end, the French employing it for units rated as low as 20 kw. The great problem was the supply of energy for mobile and semi-mobile workshops, casualty clearing stations and other consuming points in the forward area. The French, Americans and Germans linked up the main power stations with trunk lines of 30,000 volts or more. The French put up over 1,000 miles, the British 80 miles and the Germans more than 2,000 miles of high-tension lines.—*Royal Engineers' Journal,* September, 1921.

Electricity in Swedish Towns.—B. TRANEUS.—A statistical survey of electrical installations in Swedish towns, which shows that the average specific installation for electric lighting during the period 1906-1919 has increased from 44.8 kw. to 81.3 kw. per 1,000 inhabitants. At present the specific installation ranges from 56.5 kw. to 125.5 kw. for ordinary towns and up to 399 for residential towns in the neighborhood of Stockholm. The electric motor installation during the period 1906-1918 increased from 89 kw. to 1,087 kw. per 1,000 workmen, with a minimum at present of 250 and a maximum of 3,020. The saturation values are estimated at 140 kw. per 1,000 inhabitants for lighting and 1,070 kw. per 1,000 workmen for motors, which values should be reached in 1927.—*Teknisk Tidskrift, Elektroteknik,* July 6, 1921.

Researches on Wave Erosion.—W. FELLENIUS.—To ascertain whether there are any reasons to fear excessive erosion along the shores of a lake artificially maintained at constant level a series of experiments were carried out in the hydraulic laboratory of the Royal Institute of Technology in Stockholm. In a big rectangular wooden box a shore profile was made up of sand, the box was filled with water, and waves were set up by means of a motor-driven shovel wheel, while the water surface was regulated (1) according to the unregulated level curve of the lake for the period 1901-1909, and (2) according to the level curve for the same period as it should have appeared after a regulation. It was found that, contrary to the common belief, the erosion in the regulated case actually came out equal to or less than in the unregulated.—*Teknisk Tidskrift, Veckoupplagan,* July 30 and Aug. 6, 1921.

Textile Industry in the South.—JOHN GELZER.—Load curves and horsepower requirements for various types of machinery used in cotton mills are described in this article.—*Electric Journal,* November, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Better Electrical Business Campaign for 1922

"MORE business—better business" is to be the slogan for the electrical industry during 1922. A joint meeting of N. E L. A. committees—the executive committee of the Commercial Section, the wiring committee, the lamp committee and the committee on upbuilding of the industry—will be held probably early in January, when a program and plan will be worked out. Representatives of the manufacturers, jobbers and contractor-dealers who met with the last-named committee last week gave assurances that their own branches of the industry would get behind the movement.

As now proposed, the campaign will be entirely local in endeavor, but with national direction. In general the campaign will be an effort throughout the year to educate the public to a wider use of electricity through practical demonstration. It is felt that the net result will be greatly increased sales of appliances and lamps not only for the home but for the factory and store as well.

California Commission Thinks Regulation Has Saved People $100,000,000

HAD public utility rates advanced equally with commodity prices instead of being subject to regulation by the California Railroad Commission, the people of the state would have paid in the last few years $100,000,000 more for utility service than they actually did, the commission declares in its annual report for the year ended June 30, 1921, just transmitted to Governor Stephens. The commission puts the average increase in utility rates during the war and post-war periods at between 35 and 40 per cent, while retail commodity prices at the beginning of 1921 were 72 per cent higher than in 1913. A turn toward normal in market conditions last May was quickly noted by the commission, and it expresses the opinion that the peak of utility rates has been reached. Material reductions in the price of electricity and gas have already been made, the commission now views applications for increased rates with disfavor where no unusual conditions exist, and further reductions are confidently anticipated. In fact, the commission informs the Governor, a basis for rate adjustments for all the large power companies of the state will soon be established.

The assertion that regulation tends to hamper industry is declared by the commission to be a fallacy, and it points out that the public utilities under regulation are keeping pace with the rapid growth of the state. This is especially true in the development by the power companies of the hydro-electric resources of California's mountain streams. Describing this work, the commission says:

"During the year the work of harnessing the mountain streams and turning to useful purposes the state's inexhaustible supply of 'white coal' has progressed satisfactorily, while still greater projects loom in the not distant future. Hydro-electric plants of a total kilowatt capacity of 145,500 and steam plants of 47,500 kw. capacity were completed and tied into the existing distributing systems. Not including preliminary work, there are under construction new hydro-electric plants with a capacity of 146,000 kw. Developments are being carried on by the Pacific Gas & Electric Company on Pit River and tributaries, to make available 103,500 kw.; the San Joaquin Light & Power Corporation, bringing in 10,000 kw. at Kern Canyon; the Southern California Edison Company, increasing its Big Creek production by 22,500 kw., and the Southern Sierras Power Company, preparing to produce 10,000 kw. at its Levining Creek plant."

Lower Fire Insurance Rates for Power Companies

FIRE insurance rates on electric power plants and substations are to be reduced not to exceed 25 per cent, immediately, according to a statement made last week by S. E. Wolff, chairman of the N. E. L. A. insurance committee, which has been working on this situation for nine months. It is estimated that the saving to the members of the association will exceed $400,000 annually.

The committee has made an exhaustive study of loss estimates on generating stations and substations during the last five years and held several meetings to take up various phases of the work. Conferences also were held with insurance officials. New insurance or renewed insurance will receive the benefit of this reduction as soon as certain detailed revisions are completed, and it is understood that within a comparatively short time benefits likewise will accrue to those company policy holders whose insurance policies extend over a period of years.

There are many necessary details involved which will have to be worked out, but it is expected that within the next sixty days the new rates can be put into operation.

Henry Ford and Government Engineers Still Corresponding

AFTER conferring for an hour on Dec. 19 with W. B. Mayo and J. W. Worthington, engineers for Henry Ford, the Secretary of War announced that further correspondence with Mr. Ford will be necessary. Secretary Weeks explained that the engineers had presented a letter from Mr. Ford but that they had no power to act or to make comment. For that reason Secretary Weeks finds it necessary to propound certain questions in connection with the Ford letter, which is understood to be largely an expression of opinion as to

the cost of completing the Wilson Dam and building dam No. 2.

Secretary Weeks pointed out that there is great uncertainty as to the cost of dam No. 2, owing to incomplete knowledge of the foundation. He referred to the experience of the Brady interests of New York in constructing their Chattanooga project. In that case an estimate of $2,000,000 grew to $11,000,000 before the dam was completed, because of the difficulty of sealing the underlying limestone. The uncertainty as to foundation conditions at the site of dam No. 2, he said, is unusually great. This is due to the width of the river at that point.

It was the intention of Secretary Weeks to make public later in the week both the letter received from Mr. Ford and his reply to it.

Illinois Utilities to Hold Meeting in March

THE joint meeting of the Illinois State Electric Association and the Illinois Electric Railway Association will be held at the Hotel Sherman in Chicago on March 15 and 16, 1922. The morning sessions will be joint and the afternoon sessions will be in the form of separate technical sessions for each association. The annual banquet will be on the evening of March 15.

More Than Seven and One-Half Million Wired Homes

THE Society for Electrical Development has just completed a survey to ascertain the residential load of the electric light and power companies of the country, the results of which are published in the *Monthly Sales Service* for December. Following are some of the very valuable data pertaining to this survey:

Homes wired in the United States	7,636,469
Homes reached by electric service	13,000,000
Homes not reached by electric service	8,145,126
Homes reached by central-station lines but not wired	5,363,531
Homes not wired	13,508,657
Communities reached by central-station lines	14,000
Annual central-station revenue from use of electric irons	$39,000,000
Annual central-station revenue from use of vacuum cleaners	$4,750,000
Annual central-station revenue from use of washing machines	$3,500,000
Annual central-station revenue from use of electric ranges	$6,000,000

Ohio New-Business Meeting Discusses Central-Station Finance

CENTRAL-STATION finance was the topic of a full day's discussion at the recent Dayton meeting of the new-business co-operations committee of the Ohio Electric Light Association. Though the number in attendance was discouragingly small, the program was well planned and productive.

The morning session was devoted to a paper on "Public Utility Financing," by J. R. Edwards, vice-president Fifth-Third National Bank, Cincinnati, and an address on the "Relation of Public Utility Rates to the Prices of Other Commodities," by W. W. Freeman, president of the Union Gas & Electric Company, Cincinnati, and also of the Society for Electrical Development. Mr. Edwards discussed the subject from the banker's standpoint, laying stress on the merits of no-par-value stock and the importance of properly taking care of stock discounts so that the cost of financing may be written in as an item in the cost of construction and not increase the floating debt of the company.

Mr. Freeman made a clear analysis of the central-station business as compared with the ordinary commercial enterprise in its slow turnover of capital and its inability to control either its costs or its price or to finance expansions from its profits. He discussed the broad influence of these facts upon central-station financing and the necessity for informing the people fully on the commercial side of the utility business in order that they may properly recognize its commercial influence and opportunities. This more than anything else, he said, will increase the popular market for securities.

In the afternoon session Grover C. Maxwell, former secretary of the Ohio Public Utilities Commission and at present a member of the Ohio Committee on Public Information, gave an address on the work of the commission and the committee as an influence on utility financing. C. E. Yacoll, manager of the securities department, Pennsylvania-Ohio Electric Company, Youngstown, read a paper on "The Organization and Work of the Central-Station Securities Department," in which he discussed in detail this new phase of administration.

An animated discussion occupied the greater part of the time of both sessions, and out of it came a large amount of definite experience and many suggestions of practical use in meeting the local problem of selling the securities of the central-station company. Warner Jones, sales manager of the Erner Electric Company, Cleveland, brought before the meeting the opportunity offered by the present work of jobbers' salesmen in selling electrical material to farmers. This business is developing in large volume in Ohio, and Mr. Jones suggested that jobbers' salesmen be interested in selling securities of central-station companies in adjoining rural districts both to the farmers who are installing farm plants and to those who are equipping their farms for connection with central-station lines. This suggestion was considered to offer great possibilities, and a committee was appointed to investigate and report at the next meeting.

Co-operation Between New York Architects and Electrical Men

AN AGGRESSIVE policy is announced by the Architectural League of New York for bringing architects and members of the electrical industry together so that they shall mutually understand what each can produce and the advantages the designer will secure by having this knowledge. It is felt that, in addition to the two professions, the general public will benefit. For this reason the league will hold periodical exhibitions at its headquarters, 215 West Fifty-seventh Street, New York, where electrical equipment will be displayed. These exhibitions will be open to everybody.

Funds for Study of Coal Movement Assured

PRIVATE funds in sufficient amount to make possible a comprehensive study of seasonal coal movements have been placed at the disposal of the committee on mining of the President's conference on unemployment. This is the first of a series of surveys which are to be carried out by Edward E. Hunt, secretary of the conference, in co-operation with the Department of Commerce.

Lamp Industry Falls Into Building-Material Investigation

AS A PART of the investigation into building trade and material conditions being conducted by the Lockwood committee of New York, incandescent-lamp prices and the incandescent-lamp manufacturing business are to be probed on the resumption of public hearings in January. This was ascertained on good authority by the ELECTRICAL WORLD. According to this information the committee feels that the cost of lamps to the consumer is 40 per cent too high. In its inquiry the committee will attempt to ascertain whether or not the manufacturing companies are making an unfair profit and also if there is any understanding to maintain a fixed price.

Stabilization of Foreign Exchange Necessary, Says Governor Harding

STABILIZATION of foreign exchange is needed to bring about a resumption of foreign trade on a large scale, according to W. P. G. Harding, governor of the Federal Reserve Bank. Governor Harding referred to the relation between foreign exchange and the export situation in a recent address as follows:

Judging from our own history after the Civil War, many years will doubtless elapse before some European countries can restore the normal value of their currencies, but if the violent fluctuations in exchange which have marked the past two years can be prevented in future and a stabilization on some basis accomplished, it will be possible to engage in commercial and financial transactions with Europe on a much larger scale than at present. If we wish to sell our surplus products abroad, it is evident that we must continue to exchange commodities with foreign countries, for where we sell we must buy. A curtailment of production to meet merely American requirements would involve widespread non-employment and would invite disaster. On the other hand, because of the great depreciation in the currencies of many foreign countries their labor costs are much less than ours, and partly because of this fact and partly because of the high premium on dollar exchange they are able to undersell us in our own markets. One of the great problems of our national legislators today is to frame a tariff which will prevent the dumping upon our markets of foreign goods, without at the same time erecting a tariff wall so high that our exports will be greatly reduced because of the inability of foreign nations to trade with us.

Lower Railroad Rates Appear to Be Foregone Conclusion

THERE is very general recognition among the large number of traffic specialists who are attending the Interstate Commerce Commission hearing on railroad rates that the public sentiment in favor of rate reduction is so pronounced as to make it a foregone conclusion. Were the commission to announce a refusal to reduce rates, it is believed that there would be such a widespread resentment made manifest as to insure the railroading through of special legislation making a substantial rate-reduction mandatory. The fear expressed in some quarters that the commission may be influenced to such an extent by the overwhelming volume of the public demand for rate reduction as to go further than the best interests of all concerned require is not shared by most of those in attendance at the hearing, as it is felt that the commission will be conservative in any action that it may take.

The commission is not likely to authorize a blanket reduction. It is felt rather that on items which constitute a large proportion of railroad tonnage, such as coal, the reduction will be materially less than in the rates on some other commodities. At the same time it is recognized that the demand is keenest for reductions on basic commodities.

Lower Utility Taxes to Bring Power Rebate to Idaho Farmers

IDAHO farmers using electrical energy for pumping purposes are to be allowed rebates totaling $37,467. The 1921 session of the Idaho Legislature passed a law granting power companies operating in the state a rebate on taxes and provided that the amount of the rebate be apportioned among the various users of irrigation power. In compliance with the provisions of this statute the Idaho Power Company has filed with the Public Utilities Commission a report which shows that 18,326 hp. is used in the state annually for pumping water electrically. Sections of the law provide that the Public Utilities Commission shall calculate the amount of the total rebate to be placed to the credit of each consumer. After this is done an order will be issued by the commission authorizing the power company to credit the various power users of the state with their proportion of this rebate.

General Beach Reports on Muscle Shoals Status

AN EXPENDITURE of $7,500,000 can profitably be made at Muscle Shoals during the fiscal year of 1923, Major-General Beach, Chief of Army Engineers, says in his report to the Secretary of War, just made public. No work has been done on the project since last April because Congress would not make additional appropriations for it. At the present time a number of private and public utility interests are negotiating with Secretary Weeks for a lease of the plant.

A financial summary prepared by General Beach shows that to date a net total of $15,278,828 has been expended on the project, which, the report says, is about one-third completed, the percentages of completion for the various units being: Wilson Dam, 45 per cent; power house, 11 per cent, and locks, 10 per cent. The sum expended in the fiscal year ended last June 30 was $7,840,781, the principal items listed in the report being: Dam construction, $3,108,800; power-house construction, $1,017,000; main-line railroads, construction, maintenance and operation, $495,500; general plant, purchase, construction, operation and maintenance, $1,391,200; camp construction, maintenance and operation, $728,500; general expenses, including flood losses, labor recruiting and office expenses, $731,300, and lock construction, $143,800.

On last July 1 the money available of funds appropriated was $398,921, and it is stated that this will be expended by next August, as the expenses of guarding and maintaining the property average $30,000 a month.

"Should additional funds be provided," General Beach says, "the work to be done would be: Construction of cofferdam No. 2 and work thereon, continuation of excavation for lock, continuation of concrete work in dam, and continuation of excavation and concrete construction for power house. The amounts expended for each would depend upon the date and amount of the

appropriation. The rate of expenditure should be approximately $625,000 per month."

Discussing the present state of the work, General Beach observes:

"All preparatory work in the nature of camps, roads, railroads, plants and shops is completed. Earth excavation for the lock is 90 per cent completed and rock excavation 18 per cent. About 66 per cent of the excavation and foundations for the dam are completed and about 35 per cent of the concrete placed. About 48 per cent of the excavation for the power-house section is completed and approximately 4.6 per cent of the concrete placed.

"Following suspension of construction, property has been collected and stored, rented floating property returned and construction equipment placed in condition for indefinite storage or lay-up. The navigation of the river is completely blocked by the work in its present condition."

Order on Line-Extension Policy in Oregon Expected Soon

AN ORDER on line-extension policy for Oregon light and power companies will be promulgated soon by the State Public Service Commission. The case was initiated by the commission to determine, if possible, on a more liberal policy of rural extension.

Under the present policy farmers desiring to obtain electric service are required to bear the cost of the extension and are then allowed two years' service without additional cost, provided the service rendered does not exceed their pro rata share of the extension cost. The extension then becomes the property of the utility provided the service and the customers pay for service upon the same schedule as do city customers.

Engineering Council Meeting Scheduled for Jan. 4

PLANS for the development of the work of the Federated American Engineering Societies were under discussion at a series of conferences and meetings held in New York last week. President Mortimer E. Cooley and Executive Secretary L. W. Wallace met with the American Engineering Council's committee on procedure on Dec. 16, and in the evening at the Engineers' Club with the secretaries of the national societies, when questions of finance, publication and closer relations with member societies came up.

Further details of the Washington meeting of the council were announced. On Jan. 4 the meeting will start with a session of the executive board at the Cosmos Club, where the sessions of the council also will be held. The next morning the council will convene for an all-day session, at which Dean Cooley will preside. The business of the council will include the election of two vice-presidents and a treasurer. That evening the council will give an informal dinner at the University Club, among those invited to which will be the engineers of Washington. Secretary Hoover has been asked to attend and he has accepted provisionally. In addition to Secretary Hoover other prominent speakers are expected to deliver addresses.

On Jan. 6 the council will again meet in business session at 10 a.m., and in the afternoon there will be a meeting of the new executive board, the new members of which will be elected by the delegates from the national organizations and the regional areas.

At the Washington meeting the work of the past year will be reviewed and plans for the ensuing year discussed. Among the important reports to be received will be that of the special committee on non-employment. Other leading topics will be industrial waste, a national Department of Public Works, Patent Office conditions, licensing and proposed constitutional changes.

Supreme Court Holds Open-Price Plan Illegal

THE government won its suit against the American Hardwood Manufacturers' Association on Monday, when the Supreme Court held the open-price competitive plan of the association to be in restraint of trade and therefore in violation of the Sherman anti-trust law. This decision has been awaited for some time with more or less apprehension by all trade associations engaged in statistical work. There is some doubt, however, as to how far reaching this particular decision may be because of the extent to which this association went to secure trade statistics. The court was divided in its decision, the vote being six to three.

The plan adopted by the association in securing its statistics, as brought out in the record, was for each member of the association to furnish the secretary with the following six reports:

1. A daily report of all sales actually made, with the name and address of the purchaser, the kind, grade and quality of lumber sold, and all special agreements of every kind, verbal or written, with respect thereto—"the reports to be exact copies of orders taken."
2. A daily shipping report, with exact copies of the invoices, all special agreements as to terms, grade, etc. "The classification shall be the same as with sales."
3. A monthly production report showing the production of the member reporting during the previous month, with the grades and thickness classified as prescribed in the "plan."
4. A monthly stock report by each member.
5. Price lists.
6. Inspection reports.

This material was digested and each member was supplied with the following:

1. A monthly summary showing the production of each member for the previous month, "subdivided as to grade, kind, thickness," etc.
2. A weekly report, not later than Saturday, of all sales to and including the preceding Tuesday, giving each sale and the price and the name of the purchaser.
3. On Tuesday of each week the secretary must send to each member a report of each shipment by each member, complete up to the evening of the preceding Thursday.
4. He must send a monthly report showing the individual stock on hand of each member and a summary of all stocks, green and dry, sold and unsold. This report is very apparently referred to by the managing statistician as a monthly inventory of the stock of each member.
5. Not later than the tenth of each month the secretary shall send a summary of the price lists furnished by members showing the prices asked by each, and any changes made therein must be immediately transmitted to all the members.
6. A market report letter shall be sent to each member of the association (whether participating in the plan or not) pointing out "changes in conditions both in the producing and consuming sections, giving a comparison of production and sales and in general an analysis of the market conditions."

It was further provided that there should be monthly meetings of the members.

While the plan was termed open competition, the court felt that was a new name for an "old evil in a new dress." The majority opinion held:

Genuine competitors do not make daily, weekly and monthly reports of the minutest details of their business to their rivals as the defendant did; they do not contract, as was done here, to submit their books to the discretionary audit and their stocks to the discretionary inspection of their rivals for the purpose of successfully competing with them, and they do not submit the details of their business to the analysis of an expert jointly employed and obtain from him a "harmonized" estimate of the market as it is and as in his specially and confidentially informed judgment it promises to be.

This is not the conduct of competitors but is so clearly that of men united in an agreement, expressed or implied, to act together and pursue a common purpose under a common guide that, if it did not stand confessed a combination to restrict production and increase prices in interstate commerce and as, therefore, a direct restraint upon that commerce, as we have seen that it is, that conclusion inevitably must have been inferred from the facts which were proved.

To pronounce such abnormal conduct on the part of 365 natural competitors, controlling one-third of the trade of the country in an article of prime necessity, a "new form of competition" and not an old form of combination in restraint of trade, as it so plainly is, would be for this court to confess itself blinded by words and forms to realities which men in general very plainly see and understand and condemn as an old evil in a new dress and with a new name.

The "plan" is, essentially, simply an expansion of the gentlemen's agreement of former days, skillfully devised to evade the law. To call it open competition because the meetings were nominally open to the public, or because some voluminous reports were transmitted to the Department of Justice, or because no specific agreement to restrict trade or fix prices is proved, cannot conceal the fact that the fundamental purpose of the "plan" was to procure "harmonious" individual action among a larger number of naturally competing dealers with respect to the volume of production and prices, without having any specific agreement with respect to them, and to rely for maintenance of concerted action in both respects not upon fines and forfeitures as in earlier days, but upon what experience has shown to be the more potent and dependable restraints of business honor and social penalties, cautiously reinforced by many and elaborate reports, which would promptly expose to his associates any disposition in any member to deviate from the tacit understanding that all were to act together under the subtle direction of a single interpreter of their common purpose, as evidenced in the minute reports of what they had done and in their expressed purposes as to what they intended to do.

In the presence of this record it is futile to argue that the purpose of the "plan" was simply to furnish those engaged in this industry, with widely scattered units, the equivalent of such information as is contained in the newspaper and governmental publications with respect to the market for commodities sold on boards of trade or stock exchanges.

Plans to Extend Customer Ownership of Securities Campaign

TENTATIVE plans for extending the customer ownership of electric light and power securities movement to all member companies of the National Electric Light Association which desire to participate were drafted at a meeting in New York on Dec. 15 of the customer ownership committee. It has been decided to publish a standard manual on the sale of utilities' securities and a pamphlet devoted to facts regarding customer ownership activities already under way by member companies. A committee was appointed to study literature, advertising, sales letters, pamphlets, etc., already issued by companies that have undertaken the customer ownership program and to evolve from them standard material which might be used in the national campaign. Another committee was appointed to compile the salesmen's textbook and also a textbook on standards of practice.

The next meeting of the customer ownership committee will be held in New York City in the latter part of January.

Light and Power Systems Undamaged by Severe Eastern Storms

A STORM of unusual violence swept over the northeastern section of the country Monday, but the damage to electric light and power company systems was negligible. Communication wires were reported down in Pennsylvania and New York over extensive areas. The storm apparently reached its height in northwestern New York. The property damage around Buffalo and Niagara Falls exceeded $1,500,000. Reports received by the ELECTRICAL WORLD from power companies in this area indicated almost no damage to electric systems.

The Niagara Falls Power Company sustained no material damage. The Niagara, Lockport & Ontario Power Company reports that while there were numerous interruptions to service during the ninety-six-mile gale and sleet storm, the damage to physical property was very slight and did not exceed twenty-five dollars.

The worst effects of the storm were probably felt by the Buffalo General Electric Company. W. R. Huntley, vice-president of the company, stated that this was the most severe storm the company had ever experienced. The transmission lines into Buffalo from Niagara Falls were affected to a considerable extent, although at no time was there a total interruption to this service. The company's steam plant functioned as usual.

A number of pole lines carrying heavy industrial and domestic feeders were demolished, causing interruption to service in the north and south sections of Buffalo. Repairs had practically been completed by Tuesday night.

Minneapolis Street-Lighting Report Recommends Shorter Spacing

THE report of the committee on street lighting for Minneapolis contains some interesting recommendations for improving the lighting of that city. Since the subject of street illumination is so broad and varied, the committee felt that the city should place the control of the street-lighting system in the city engineering department under the direct management of an electrical engineer. Other projects under consideration were to adopt a system which would give fairly uniform illumination on the street surface and to grade the intensity according to the night traffic on the streets. One way of creating this uniform intensity would be the use of 30-ft. standards at intervals of 240 ft. instead of the present 15-ft. standard spaced at 100 ft. or 120 ft. Several photographs were contained in the report, showing a comparison between these two sources of illumination. Virtually all the light beams of the lamp hung from the 30-ft. standard were evenly distributed by reflectors on the surface of the ground between two standards.

The committee discussed the problem of glare at considerable length, advocating the proper use of heavy durable refractor globes for the elimination of this evil.

Licensing Law for New York Engineers Now Functioning

THE New York State enactment licensing practicing engineers, which became a law last May, has just begun to function, and at a session of the board of five engineering examiners 241 applications were considered and 171 passed. This board, which represents each of the five branches of engineering — electrical, mining, mechanical, chemical and civil—passes upon all applications.

This professionalizing of engineering has rapidly spread over the country until it has been agitated or become a law in forty of the states. An effort is being made to harmonize all of the different laws so that they will be co-operative and enable a licensee in any state to practice in any other state.

Gas-Filled Lamp Patent Upheld in Highest British Court

THE British House of Lords, court of last resort in English patent cases, has unanimously upheld the English patent covering the Langmuir gas-filled incandescent lamp, having reversed the decision of the lower court, according to word just received in the United States. The final determination of this case was in a suit for infringement brought by the British Thomson-Houston Company against the Corona Lamp Works, Ltd. This patent corresponds to the American patent No. 1,180,159, April 18, 1916, owned by the General Electric Company, which was sustained in the suit of General Electric Company vs. Nitro-Tungsten Lamp Company and in the suit of General Electric Company vs. Alexander et al.

Proposed California Power Act Denounced by Banker

DENOUNCING the proposed California "water and power act," which its advocates hope to submit to general referendum in November of next year, as a "distinct step toward socialism," and declaring that any such plan for state ownership would be an economic failure, L. H. Roseberry, vice-president of the Security Trust and Savings Bank of Los Angeles, speaking at a luncheon of directors of the Federated State Societies recently, said:

"The management of the power business is purely a private enterprise and should be left to private initiative and capital to assure efficient results and promote economy and efficient operation. While the state might in justice own its water supply, which is a natural monopoly, there is no more justification for going into the power business than into the manufacturing of clothing, farming or other food business. It is an effort to inject government into business, socialistic in its purposes and destructive to the institution of private ownership of property upon which this government and our civilization are founded. This menace is a type of radicalism which has proved disastrous to Europe and which is threatening our own business and civic institutions.

"Little or no control is placed over the expenditure of this huge sum or the administrative acts of the board which is to disburse it. There is no justification for the act, because the present California Railroad Commission is functioning above criticism in the treble interests of the utility companies, the consumers and investors in the utility's securities. This public regulation gives every benefit of public ownership without destroying initiative or assuming the liabilities of operators."

To Investigate Northern Ontario Electrification

THE Temiskaming & Northern Ontario Railway Commission has decided to make an investigation as to the feasibility of electrifying the road, with particular reference to the extension from Cochrane to Oil Can Portage, 70 miles further north. It is estimated that 500,000 hp. can be developed on the Abitibi River, between Kettle Falls, 16 miles north of Cochrane, and Oil Can Portage or New Post. The commissioners have authorized S. B. Clement, chief engineer of the Temiskaming & Northern Ontario Railway, and J. G. Kervy, consulting engineer, of Toronto, to make a report as to the power possibilities, the power required and the feasibility of the scheme, the report to be ready in three months.

The plans, profiles and all matters pertaining to the extension of the road from Cochrane have been approved by the provincial government. Contracts have been let for ties and rails for the first 40 miles of the extension.

Hoover Made Chairman of Colorado River Commission

PRESIDENT HARDING has appointed Secretary Hoover as federal chairman of the Colorado River Commission recently created jointly by Congress and the seven states traversed by the river. The appointment has been made with the approval of the governors of the states concerned—California, Arizona, Nevada, Utah, Colorado, Wyoming and Montana. It is the duty of the commission to determine a plan for the development of the immense power and irrigation possibilities of the river and to make recommendations to Congress. One of the first questions before it will be to determine whether the construction of the dams along the river should be undertaken by the federal government or whether they should be allotted to different private interests.

The Irrigation Service advocates that the first construction should be a dam about 600 ft. high at Boulder Canyon in Arizona, costing about $40,000,000, which would give an initial amount of upward of 600,000 primary horsepower. This dam would increase the irrigated acreage in Nevada, Arizona, California and Mexico by 1,300,000 acres and would give such flood control as would protect the Imperial Valley from destruction by a break in the river banks.

New Transmission System to Serve Western Kentucky Coal Mines

AN EXTENSIVE transmission system has been planned by the Kentucky Utilities Company to serve all the coal mines in western Kentucky and larger towns in that section requiring service. The company has just closed contracts with five coal mines for an aggregate of 850 kw. connected load, to yield an annual revenue of $30,000. Negotiations are in progress for several more mining contracts. Central City and Greenville, now served by the company, will soon be connected to the new transmission system, effecting a substantial saving in operation and permitting the addition of more new business.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Metric System Bill Up Again.—Hearings on Senator Ladd's bill providing for the compulsory adoption of the metric system after ten years were reopened at Washington on Dec. 14. The hearing is being conducted by a sub-committee of the manufactures committee of the Senate, of which Senator McNary of Oregon is chairman.

A Big Lifting Magnet.—Among the biggest electric lifting magnets of the world is one recently supplied to a British steel works by a Birmingham (Eng.) manufacturer. The magnet is 66 in. in diameter, weighs 5,800 lb. and is, says *Engineering*, capable of raising a load of 50 tons. It is used in a plant for handling and breaking scrap metal and delivering it to the charging box for furnace filling, and it is handled by a 25-ton overhead crane.

Boquillas Dam Called Second Largest in Storage Capacity.—A Mexican government official who recently returned from a visit of inspection to the now completed Boquillas Dam, in the State of Chihuahua, which has been built for power and irrigation purposes in the valley of the Conchos River, declares that the storage capacity of this great development will be 106,000,000,000 cu.ft. and second only to that of the Elephant Butte Dam, near El Paso, Tex.

Electrical Workmen's Earnings on Railroads.—Figures issued by the Interstate Commerce Commission indicate that for the month of July last the earnings of workmen concerned with electrical operations on the Class I railroads of the United States were: General foremen, electrical transmission, $238; assistant general foremen, electrical transmission, $215; linemen, $159; electrical inspectors, $202; electrical workers, Class A, $170; electrical workers, Class B, $167; electrical workers, Class C, $130; laborers in power plants, $94; common laborers in power plants, $82; stationary firemen and oilers (electrical plants), $130.

Simple Type of Radio Direction Finder.—An important application of the radio direction finder is to expedite the location of a wrecked ship by a rescuing ship. If the former vessel can continue to send out radio signals, a ship equipped with even a very simple type of direction finder can lay a course directly to the wreck, even in time of heavy fog. A rescuing ship not equipped with a radio direction finder may require many hours to locate a vessel in distress, even though near at hand, if there is a fog, and this delay sometimes results in a serious loss of life. A very simple type of direction finder is described in the report of the technical conference on radio regulation held in Paris a few months ago. It consists of a square wooden frame about 5 ft. on a side, wound with eight turns (spaced ½ in.) of No. 20 insulated copper wire, and it can be used with auxiliary simple receiving apparatus. This instrument can be held in the hand by a person on deck and fairly accurate bearings taken on a ship sending out distress signals. The working distance depends upon the sensitivity of the detector and amplifier used with the direction finder. The accuracy increases as the ship is approached.

Electrical Progress in El Paso.—Improvements involving the expenditure of $840,000 have, according to a dispatch in the *Manufacturers' Record*, been completed at the plant of the El Paso (Tex.) Electric Railway Company. The additions and improvements to plant and equipment were made to take care of increased demands for electric power throughout the city, and more than 200 plants of many kinds are now served in addition to power for lighting purposes and steel railway use. A 75,000-kw. turbine together with the necessary auxiliaries is part of the new equipment.

Illinois Properties To Be Merged.—Announcement has been made that a merger of the railway, gas, electric and heating properties of the Springfield (Ill.) Consolidated Railway Company and the Springfield Gas & Electric Company and the electric and heating properties in DeKalb and Syracuse, Ill., is planned, subject to the approval of the bondholders, the new company to be known as the Illinois Power Company and to have a capitalization not to exceed the combined capital of the constituent companies, which is $10,025,000. The properties concerned are controlled by the Commonwealth Power, Railway & Light Company.

Program of Northwest Electrical Service League.—The Northwest Electrical Service League has called two meeting of jobbers' salesmen. The first was held at Seattle, Wash., Nov. 19 with an attendance of forty, the second at Portland, Ore., Nov. 26 with an attendance of thirty. Auxiliaries are being planned for Spokane and Tacoma. Meetings will take place at least once every two months. Constructive work will, according to Stephen Ivan Miller, Jr., the manager-secretary, be at once undertaken along the lines of sales "round tables" in order that successful salesmen may contribute their ideas and experience to the entire group.

Harnessing the River Jordan.—The placing of a contract by the Palestine government for a hydro-electric system in connection with the River Jordan has, according to the London *Engineer*, been the subject of inquiry in the British House of Commons. It appears that the contract was awarded to a Russian, and the Colonial Secretary was asked whether tenders were obtained from other sources before reaching a decision. The reply given indicated that the contractor was acting in cooperation with the Zionist organization, and the Palestine government as well as the Colonial Office approved of the concession. The works, which will utilize the waters of the Rivers Jordan and Yarmuk and the other streams for the generation of electric power throughout the country, will, it is understood, employ local labor to a large extent. The exact terms of the concession have not been stated, and it is uncertain whether the government is assuming any financial responsibility.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

British Columbia Co-operative League Changes Name.—The advisory council of the British Columbia Electric Co-operative Association has decided to change the name of the organization to "Electrical Service League of British Columbia."

American Physical Society.—At the Toronto meeting of the American Physical Society on Dec. 27-31, Prof. J. C. McLennan will give an address on "Atomic Nuclei and Extra-Nuclear Electronic Configuration." This will be followed by a symposium on the quantum theory.

American Welding Society to Have Western Sections.—The American Welding Society, which has its headquarters in New York, will add five sections to the parent organization with the completion of preliminary steps taken on the Pacific Coast by C. A. McCune, vice-president of the society. Work in the establishment of the sections is under way in Seattle, Spokane, Portland, San Francisco and Los Angeles, and it is expected that each of the five new branches will be thoroughly organized by the first of the year.

Section Meetings of the A. I. E. E.—Future Institute section meetings scheduled include these: Dec. 29, Atlanta, "Muscle Shoals," by C. G. Adsit, chief consulting engineer Georgia Railway & Power Company; Jan. 12, Bethlehem (Lehigh Valley Section), "Electricity Aboard Ship"; Jan. 20, Baltimore, "Use of Electricity for Industrial Heating," by C. F. Hirshfield, chief of research department, Detroit Edison Company; Jan. 27, Salt Lake City, "Possibilities of Electrical Engineecring in the Future Development of Utah," Lafayette Hanhett, president Utah Power & Light Company; Jan. 27, New York (jointly with A. S. M. E.), "Industrial Power Requirements."

Coming Meetings of Electrical and Other Technical Societies

American Physical Society—Toronto, Dec. 27-30.
American Association for the Advancement of Science—Toronto, Dec. 27-31.
A. I. E. E. Section Meetings—Atlanta, Dec. 29; Lehigh Valley, Jan. 12; Baltimore, Jan. 20; New York, Jan. 27; Salt Lake City, Jan. 27.
Massachusetts State Association of Electrical Contractors and Dealers—Springfield, Jan. 5.
American Engineering Council—Washington, Jan. 5-6.
A. I. and S. E. E.—Philadelphia Section, Jan. 7; Chicago Section, Jan. 27.
Western Association of Electrical Inspectors—Chicago, Jan. 17-19. (For program see issue of Dec. 17, p. 1243.)
American Society of Civil Engineers—New York, Jan. 18-19.
Association of Municipal Electrical Utilities of Ontario—Toronto, Jan. 26-27.
Lighting Fixture Dealers' Society of America—Milwaukee, Jan. 30-Feb. 2.
New Mexico Electrical Association—Albuquerque, Feb. 13-14.
American Institute of Electrical Engineers—Midwinter convention, New York City, Feb. 15-17.
National Meter Committee, N. E. L. A.—Springfield, Ill., Feb. 15.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Approval of "Split Inventory" Basis of Valuation.—The Wisconsin Railroad Commission has placed itself on record as favoring the "split inventory" basis of valuation. "This method of determining property value," the commission explains, "consists in applying prewar nominal prices to property installed before the war and investment cost on all property installed since. The method is in accordance with the established policy of the commission and is used in preference to the 'present cost of reproduction' basis as being fairer in the long run to both the company and the consumers. It is also more permanent and is not affected by possible abnormal market prices at the time of the appraisal."

Should Return Be Allowed on Full Value of High-Priced Site?—The Hawaii Public Utilities Commission, dealing with the question of return on an unnecessarily expensive site, said recently: "Public utilities are a vital necessity in the affairs of every community; their sound financial standing and the confidence of the investing public in the opportunity for a limited but sure reasonable return under efficient management is vitally necessary, not only to the continued prosperity of the utilities but to the ability of those utilities to continue by their development an expansion adequately to serve the public. If utilities are ever placed on a basis where their return is limited to a fair return under the most skillful management, subject to further deduction by way of penalization to the uttermost farthing for every error in judgment, the result will necessarily be the rendering so unattractive of public utility investments that the further development and expansion of public utilities will from a business standpoint become practically impossible."

Improper Financing Condemned.—In granting permission to the Coast Valleys Gas & Electric Company to make new stock issues and cancel claims for unpaid accumulated dividends, the California Railroad Commission sharply criticised overcapitalization as practiced before the issue of the securities of public service corporations was placed under its control. Such improper financing, it said, "has resulted in some utilities depending entirely on borrowed funds or earnings for moneys to pay for additions and betterments. The result has been the payment of high interest rates for loaned capital. The inability to sell stock is not always due to low earnings on property used and useful in rendering service to the public, but frequently is caused by the fact that a large amount of stock is outstanding which does not rest upon any real equity. It is only through refinancing and the sale of stock that such conditions can be remedied. It is unfortunate that the commission has not sufficient power to take positive action in these matters. Antiquated financial structures have seriously handicapped utilities in their financing and have been a cause in rendering unsatisfactory service to the public."

Damages Awarded in Excess of Insurable Amount Are Not an Operating Expense.—Awards in judgments returned against public utilities for personal injuries not covered by insurance cannot be passed on to ratepayers, according to a decision rendered by the California Railroad Commission in passing on the electric rates of the Western States Gas & Electric Company, operating in Stockton. The rule laid down as to damage awards is that the cost of insurance is an allowable operating charge, whether a utility carries insurance or assumes the risk, but where a judgment award exceeds the insurable amount the stockholders must stand the loss. The company wished to amortize in its operating expense account over a period of three years $36,000, the remainder of a personal injury judgment after a casualty company had paid the amount of its liability. Commenting on the company's proposal to amortize this sum in operating account, the commission said: "From a study of public utility commission decisions and court decisions it appears that in general allowance is made in operating expenses for either the reasonable insurance to cover public liability or reasonable cost of carrying such insurance, and that allowance for excess damages over insurable amounts should not be made. The amount in question is in excess of insurance carried. Applicant at this time is carrying public liability insurance, and the amount included in general expenses should be eliminated."

Contract Involved in Sale of Private Generating Plant to Central-Station Company Discriminatory.—Opposing an application to the Utah Public Utilities Commission from the Utah Power & Light Company for increased rates for steam service, the Hotel Utah Company contended that in 1916 it had entered into a contract for the sale of its own plant for the generation of electricity, steam and hot-water heat and refrigeration to the Utah Power & Light Company for a certain price and at the same time entered into service contract with the latter company whereby the hotel company was to be furnished electric and steam-heating service for a stated price. It was further contended that the contracts were for such consideration as would come under the exception rule or proviso set forth in the public utilities act of Utah, and that the consideration had at the time of the said transaction was such as to prohibit the changing by the commission of the rates agreed upon in the contract. The commission, after making an inquiry into the value of the transferred property for revenue as compared with its purchase price, denied the hotel company's contention, asserting: "The record clearly indicates that the effect of preserving the contract rate under the admitted facts in this case would be either to prevent the rendition of central-station steam service, by reason of its inability to pay expenses, or to cast upon the remaining consumers of such steam service the burden of making up the deficit, over $66,000 per year, resulting from the service to the Hotel Utah Company at the contract rate. The contract rate is therefore discriminatory."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Municipality Has No Right to Appeal Against Rates by Which It Is Not Affected.—In City of Oswego vs. People's Gas & Electric Company of Oswego, the city authorities sought to enjoin the utility from enforcing its rates against private consumers. The New York Supreme Court has dismissed the proceedings because the municipality is by the terms of the Public Service Commissions law exempt from the rates and has therefore, the court holds, no right to represent other consumers in such proceedings, which must be brought by a real party in interest. The power conferred on the mayors of cities under the law applies only to the institution of proceedings before the commission and provides no basis for an action in the courts. (190 N. Y. S. 39.)*

Service Charge Declared Illegal in New York.—The Appellate Division of the New York Supreme Court for the Third Department has held the service charge of 40 cents permitted the Rochester Gas & Electric Corporation by the Public Service Commission to be illegal. Three of the justices voted for the reversal of the commission's order and two dissented. Opinions filed previously by the New York Supreme Court have held that the commission is empowered to make such a charge, and that it is not a rental or meter charge within the meaning of the transportation corporations law, which prohibits a direct or indirect rental or meter charge. (See ELECTRICAL WORLD for Nov. 5, page 944.) The Rochester Gas & Electric Corporation is carrying the case to the highest court of the state, the Court of Appeals, and from it a definitive opinion is expected.

Powers of Oklahoma Commission.—In Oklahoma Gas & Electric Company vs. State Corporation Commission the Supreme Court of Oklahoma has determined (1) that the commission may prescribe a temporary schedule of rates to be effective until it has had time to evaluate the company's property, (2) that it is not necessary for the commission to fix a time limitation for a temporary rate order, (3) that in fixing a rate the commission may take into consideration former earnings and probable prospective earnings, former cost of operation and probable prospective cost of operation, with the object of so adjusting the rates as to prevent the public utility from practicing extortion on the public and yet allow it a fair and reasonable return, and (4) that the legislative power of the commission over rates is not confined to prescribing permanent rates but may be exercised as the exigencies of the times and changing conditions demand. (202 Pac. 505.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

William A. Durgin has been placed in charge of the new division of the Department of Commerce which will be concerned with furthering the elimination of waste by the simplification

W. A DURGIN

of commercial practices. Leave of absence was given to Mr. Durgin by the Commonwealth Edison Company of Chicago that he might direct this work. Mr. Durgin was born in Rochester, N. Y., and was graduated from the Massachusetts Institute of Technology. Immediately after his graduation he joined the engineering staff of Stone & Webster and took that firm's student course in the Boston office. He was then sent to Terre Haute in the capacity of assistant lighting superintendent of the local central-station company. From 1904 to 1914 he was engaged in the testing department of the Commonwealth Edison Company of Chicago. During this period he specialized in the location of faults in underground cables and studied the particular problems of large alternating motors. From 1914 to 1919 he served the Commonwealth Edison Company as light specialist, being promoted to the post of lighting assistant to the vice-president. In December, 1920, he was made secretary of the budget and expense committee and of the advisory committee of the company.

J. P. Clark, who has been associated with the securities department of the Central Maine Power Company since that department was first established, has been transferred to the operating department and will hereafter devote all his time to following up petitions for line extensions and to selling stock to finance extensions which the company undertakes to build. Mr. Clark brings into this work the new idea of soliciting stock sales from companies wishing extensions made by the Central Maine Power Company.

C. Murphy Chandler has been elected chairman of the Georgia Railroad Commission for a sixth consecutive term.

F. M. Doolittle, who has been instructor in electrical engineering at Yale for the past two years, has resigned and is devoting himself entirely to his manufacturing interests in New Haven, where he is manufacturing radio apparatus and electrical specialties.

L. B. Herrington, the newly elected president of the Kentucky Association of Public Utilities, comes to this position armed with fifteen years of experience in the problems of the utilities. Mr. Herrington was born in Albany, Ga., April 8, 1880, and is a graduate of the Central University of Kentucky and the law department of Mercer University, Macon, Ga. In 1905 he became president of the Richmond (Ky.) Electric & Power Company and built the power plant which still serves that place. Later, this company erected the power plant at Gallipolis, Ohio, and the telephone system at Orlando, Fla. These properties were sold to local syndicates, and in April, 1917, Mr. Herrington joined the Kentucky Utilities Company, Louisville, Ky. He has twice represented Madison County in the Kentucky Legislature and was presidential elector from the Eighth Congressional District in 1916. Mr. Herrington is now president of the Electric Transmission Company of Virginia, operating extensively in the coal fields of Lee and Wise Counties; president of the Ken-

L. B. HERRINGTON

tucky Light & Power Company, which operates five utilities in western Kentucky, and also vice-president in charge of operations of the Kentucky Utilities Company, which serves thirty-seven cities and towns in Kentucky and the coal fields of the southeastern and western part of the state.

Prof. Henry Jordan has begun work as head of the department of electrical engineering in the State College of Colorado at Fort Collins. He is a graduate of Virginia Polytechnic Institute.

Walter F. Finlay, Jr., was elected a manager of the American Society of Mechanical Engineers at its annual meeting held in New York City in December. Mr. Finlay was born in Hoboken, N. J., in 1882 and was graduated from Cornell University in 1904 with the degree of mechanical engineer. Soon after graduation he entered the employ of the Interborough Rapid Transit Company, his first work with that company being in connection with

W. F. FINLAY, JR.

the construction of the Fifty-ninth Street power station. He later assisted in experimental and research work in connection with schemes for the development of that station and the promotion of its efficiency. In 1909 Mr. Finlay left the Interborough to go into engineering work with the New England Engineering Company, and subsequently became associated with his father in commercial work, returning to the Interborough company in 1915 to take charge of the installation of turbines and of auxiliary mechanical equipment necessitated by the extensions to the subway and elevated systems. He was subsequently appointed superintendent of motor power of this company, and in addition to supervising operation of its power-generating system he had charge of the engineering and construction work coming within the scope and control of the department. In 1920 he resigned from the Interborough to become vice-president of the American Water Works & Electric Company.

V. C. Grant has resigned from the position of superintendent of the Enterprise (Ore.) Electric Company to accept the management of the Ilwaco (Wash.) Light & Power Company.

Lloyd P. Joubert, formerly with the Todd Dry Dock & Construction Company, is now electrical engineer with the Tacoma (Wash.) lighting department.

David P. Barrows, president of the University of California, has been appointed a member of the National Research Council for a term of three years.

Edward A. Deeds, recently elected vice-president of the American Society of Mechanical Engineers, was born near Granville, Ohio, in 1874. He was graduated from Denison University in 1897 with the degree of B.S. After studying electrical engineering at Cornell he became assistant draftsman for the Thresher Electric Company at Dayton, Ohio, and within a year was advanced to the position of chief engineer and superintendent. He resigned in 1900 to become construction and maintenance

E. A. DEEDS

engineer for the National Cash Register Company. After two years with this company he resigned to go to Niagara Falls, where as chief engineer he designed the plant and equipment of the Shredded Wheat Company, and was for a time in charge of operation of the plant. He then returned to the National Cash Register Company, as vice-president in charge of engineering and production. At the time of his resignation from this company in 1914 he was vice-president and general manager. Working together, Colonel Deeds and C. F. Kettering developed the electric starting, lighting and ignition device for automobiles, founding the Dayton Engineering Laboratories Company. Selling this business in 1916, Mr. Deeds and Mr. Kettering devoted themselves to the Domestic Engineering Company, another industry created by them for the manufacture of isolated house-lighting outfits. Colonel Deeds is president of this organization. In April, 1917, Colonel Deeds became a member of the Munitions Standards Board, then a member of the Aircraft Production Board. He was largely responsible for the broad foundation upon which the aircraft-production program proceeded and for the development and production of the Liberty engine. He is a member of the American Institute of Electrical Engineers, the Society of Automotive Engineers, and one of the charter members of the American Electrochemical Society. He belongs to the Engineers' Club of New York and is president of the Engineers' Club of Dayton. He is vice-chairman of the board of trustees of Denison University.

A. H. Kohlbusch has been appointed manager of the Chicago office for Payne Dean Limited, with headquarters in the Lumber Exchange Building, 11 South La Salle Street. Previous to May 1, 1921, he had been connected with the Public Service Electric Company of New Jersey as construction superintendent. Mr. Kohlbusch was graduated from the mechanical engineering course at Columbia University in 1913.

Charles H. Bromley, formerly technical director of the Richardson-Phenix Company, Milwaukee, has been appointed manager and chief engineer of the newly formed Richardson-Phenix division of S. F. Bowser & Company, Inc. His headquarters will be at Fort Wayne, Ind.

J. D. Mooney, general manager of the Remy Electric Division of the General Motors Corporation, has been promoted to the position of operating vice-president in the East for the Motors Corporation. I. J. Reuter has been appointed general manager of the Remy division. Mr. Reuter is a graduate of Purdue University, in the class of 1907.

W. H. Smedley has been appointed acting manager of the Halifax office of the Northern Electric Company, Ltd. Mr. Smedley has been with that company for fifteen years, first becoming connected with it in 1906 at the manufacturing plant in Montreal. In 1910 he was transferred to the Montreal local distributing house, which had just been opened, and was put in charge of service and stock maintenance. In 1917 he was appointed district stores manager in Montreal and in 1919 held the same position in the Toronto district. A year later he was placed on the general sales manager's staff in order to make a special study of merchandising methods of his own and other companies and held that position until Nov. 1 of this year, when he received his present appointment as acting manager of the Halifax office.

Obituary

John Wheeler Duntley, fifty-five years old, founder of the Chicago Pneumatic Tool Company, was killed in Chicago on Dec. 15 by an automobile truck. Mr. Duntley was one of the first men to bring pneumatic tools into use, working with Charles M. Schwab to place them on the market. He established the Chicago Pneumatic Tool Company in 1884 and was president of the company until 1909.

Robert H. McKean, manager of the credit department of the McGraw-Hill Company, Inc., died at his home on Dec. 17, 1921. Mr. McKean's services began with the *Engineering and Mining Journal* in April, 1902, as assistant in the accounting department. Within two years he had been promoted to the position of head bookkeeper, and at the time the periodical was purchased by the Hill Publishing Company he was in charge of the accounting department. About a year later Mr. McKean was appointed manager of the *Engineering and Mining Journal*, a position he held until he was elected a director and secretary of the Hill Publishing Company. At this time he assumed the management of the credit department of the company. He was a director and secretary of the Hill Publishing Company until its consolidation with the McGraw Publishing Company. After the consolidation he became manager of the combined credit department and held this position until his death. Mr. McKean's loss to the McGraw-Hill Company, Inc., will be a serious one because of his unusual ability in his chosen work. His ready wit and keen sense of humor will be missed by his associates.

W. Caryl Ely, vice-president of Barron G. Collier, Inc., and president of the American Electric Railway Association from 1904 to 1906, died on Dec. 14

W. C. ELY

from heart failure. Mr. Ely was a man of prodigious enterprise. He was perhaps best known among the railway men as the former head of the International Railway, Buffalo, and for his work with the Collier organization, but these are only a small part of activities to which he had turned his attention from time to time. Mr. Ely's charm of manner and invariable courtesy and consideration for others endeared him to his many friends. At the same time his sound judgment and forensic ability made him a national leader among men. Mr. Ely was born in Middlefield, N. Y., in 1856 and was graduated from Cornell University. He studied law, was admitted to the bar at Ithaca, N. Y., in 1882 and practiced in East Worcester, N. Y., after which he removed to Niagara Falls. In 1899 he gave up the practice of law to become president of the International Traction Company of Buffalo and the International Railway. In 1891 he was nominated by his party for justice of the Supreme Court. Mr. Ely was one of the organizers of the Niagara Falls Power Company and was identified with the Buffalo-Niagara Falls Electric Railway, having been the first president of that company. Upon the union of the International Traction Company and the International Railway, Mr. Ely became president, serving in that capacity until March, 1905. For six years previous to 1910 Mr. Ely was president of the Ohio Valley Finance Company and engaged in the construction and operation of electric railway and electric lighting properties in the Ohio Valley between Pittsburgh and Wheeling. Among other companies in which he was interested were the East Liverpool Traction & Light Company, the Ohio River Passenger Company and the Steubenville & Liverpool Railway & Light Company.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Transformer Market Easier with Moderate Production

ALTHOUGH nothing spectacular is in evidence in the transformer market at this time, part-time production is being carried on by most manufacturers under conditions favorable for rapid expansion should business increase speedily. All over the country there is a constant absorption of distribution transformers for utility service, and there has been a moderate sale of the power type of transformers for foreign installation outside of Europe. Raw materials are plentiful, and a recent temporary shortage in high-grade steel has been overcome satisfactorily. At no time did this condition cause any serious hardship, but with the advent of better business in the industry as a whole orders on the mills will tend to approach volumes that mean more economical handling per unit than of late. Insulating materials are said to be in unusually good supply at this time.

Steady prices on the whole characterize this field, and buying seems to be more dependent on general business conditions than on apparatus cost to the purchaser. In other words, if a central-station company or industrial buyer of transformers sees an opportunity to utilize such equipment, he is not likely to put off ordering very long for fear that there may be price changes. Reductions have been made consistently with former price levels and new costs, and where the need for new equipment exists, purchases may be made on the assumption that prices are now reasonably stable in the opinion of representative manufacturing and distributing interests. Some manufacturing for stock is under way, and productive organizations have been kept well enough in hand to meet larger requirements on short notice. Deliveries are excellent, and the tendency toward higher voltage selections for distribution as well as for transmission gives evidence of marked interest in economic applications on the part of operating companies and industrial concerns.

Heavy Buying of Telephone Line Material in New England

UNPRECEDENTED purchases of telephone-line material were necessitated in New England by the recent record-breaking sleet storm. Both the New England Telephone & Telegraph Company and the American Telephone & Telegraph Company entered the market by the Monday morning following the beginning of the storm on Sunday, Nov. 27. Existing emergency stocks of poles and other line material were drawn upon heavily. Most of the purchases of the New England company were made through J. C. Kilday, supervisor of supplies, and by him through T. L. Holmes, manager telephone department, Western Electric Company, Inc., Boston. The warehouses and yards of the latter organization in the East were heavily drawn upon, and for about a week staffs worked literally day and night to fill emergency orders. Shipments into New England were largely made by rail and the wire factories cooperated, as did other plants in pushing material forward to the limit. Motor-truck shipments were extensively used in distributing material within the Massachusetts areas hardest hit.

Up to Dec. 12 the New England company had ordered the following major material for immediate field service: 12,000,000 ft. No. 17 twisted-pair and 1,500,000 ft. No. 14 twisted-pair for outside distributing lines for temporary toll and exchange work; 400,000 lb. of bare copper wire, chiefly No. 12, for permanent toll lines; twelve carloads of cross-arms; 100 tons pole-line hardware; 430 tons bare iron wire, and 325 sets linemen's tools and equipment. The telephone company lost approximately 10,000 poles and its total damages, General Manager W. R. Driver, Jr., stated to the ELECTRICAL WORLD, will be easily $1,500,000. About 5,000 miles of toll lines were down in New England. To replace lines destroyed about 400,000 linear feet of underground cable have been purchased, and the American company has ordered about 50 miles of sixty-circuit cable to be installed in an underground duct line between Boston and Worcester, previously constructed in anticipation of traffic expansion. Over 7,000 poles were among the earlier New England orders. Shipments at the rate of 50 tons per day left the Boston warehouse of the Western Electric Company during the first week after the storm and at the rate of 75 tons per day from other distributing stocks.

Early Improvement in Wiring Supplies Market Anticipated

ALTHOUGH a slight recession in demand has struck manufacturing plants turning out schedule material within the past two or three weeks, it is not believed by close observers of market conditions that this will last. Some of the best-known producers are making finished material for stock at this time in addition to filling routine orders from jobbers. If the demand should continue light after the middle of January, it is expected that some curtailment of output would have to be put into effect; but the feeling is widespread in the market that as soon as inventory days are past a much more healthy tone to orders will manifest itself. There is heavy pressure on building concerns to expand their activities on price bases which will permit more satisfactory investment of capital in homes and mercantile establishments, and broad general gains in the business situation are sure to be reflected next year in a better demand for wiring supplies, in the opinion of several manufacturers who discussed this matter a few days ago with a representative of the ELECTRICAL WORLD.

One of the chief obstacles to a more rapid expansion of output in schedule materials is the hesitation of the jobber to buy substantially for stock, in the opinion of leading manufacturers. The jobber, on his own account, feels that until the demand increases much more, and until prices are stabilized to a greater degree he must move with caution and hand-to-mouth buying results. The manufacturer points out that the jobber expects 24-hour deliveries on most standard products and greatly desires that distributers' stocks shall be built up somewhat more than of late, particularly as space is lacking in many plants for convenient storage of wiring supplies beyond three or four weeks' output down to the production of a few days. The storage practices of different manufacturers vary considerably, but all those interviewed were looking forward to the building up of more diversified stocks in distributers' hands as a real possibility in the coming year.

The situation is a difficult one all around, but as building operations increase—and improved credit is helping here—the demand upon the jobber is bound to grow, and with larger volumes of sales, local stocks can safely be increased if the buyer is reasonably satisfied that stable or minimum prices are with us. Within the past year not a little liquidation in wiring device prices has occurred, and while prophecy is not to be indulged in freely, it may be said that a

little more purchasing for stock by distributers does not appear likely to lead to any substantial losses in view of the present tendencies of copper prices. The manufacturer's viewpoint is that the jobber may now well ask himself if schedule material prices are not sufficiently close to the latter's ideas of what is reasonable to warrant a more liberal policy in purchasing for future stock, unless the particular jobber still finds himself heavily oversupplied with this class of material.

Copper Research Association Working to Reduce Costs

AT THE first annual meeting of the Copper and Brass Research Association, held in New York Dec. 6, it was announced that particular attention is being paid to technical production and sales methods in a continuing effort to reduce costs of copper to the consumer. The effect of this will probably not be felt by the electrical industry for some time as the price of copper is low now. Many mines cannot be operated profitably at present copper prices, but as soon as quotations resume their proper levels—and this may be soon—the effort by producers to keep down costs will react favorably on electrical manufacturers and central stations.

That the producers realize the need to keep costs down in order to increase consumption is evidenced by a part of the convention announcement which reads as follows:

"As we view it, in the new business era at hand, we shall see a keener competition, more scientific buying and a greater scrutiny of values in relation to price than ever before. No industry can hope permanently to prosper unless it has a product which it is really economical for the public to buy."

Position of Farm-Lighting Plants Becoming More Favorable

A SURVEY of the prospects for the sale of farm-lighting plants during the next few months indicates that, although agricultural conditions in many parts of the country are more or less bad, intensive sales methods and education of the farmer may be expected to bring good results. Sales in some territories have improved in the last few months noticeably, though it is still impossible to consider them good. The best sign of all, however, is that the farming class is showing interest in the possibilities of these units, and when the financial situation of the farmers is bettered a large demand will undoubtedly develop of itself. Conditions in the East may be summarized as fair actually and more than good potentially.

A fine outlook for 1922 business in farm-lighting sets is reported from New England. Farming districts with a few important exceptions prospered this year, and conditions are improving generally in the northern and central parts of this territory. A leading distributer's sales for 1921 exceed those of 1920 by 7½ per cent. Vigorous sales effort is yielding fruit and the territory is far from saturated. Conservatively, New England should easily absorb 20 per cent more sets next year than this.

The outlook in the Southeast is reported quite encouraging, one of the largest jobbers of this specialty reporting that, owing to advertising and sales campaigns recently undertaken, he is having unusual success in sales and is in receipt of many inquiries. This particular jobber is arranging to sell plants on twelve monthly payments, taking the purchaser's notes for this period. Business conditions in a certain section may be found good, while in a section near by where no cotton was picked they are very poor.

Expectations are that the largest volume of sales will come from southern Alabama, northern Georgia and North and South Carolina in the order named. Special efforts are to be made to boost the business in Florida. Recent price reductions should begin to make themselves felt in the Southeast within the next thirty days.

Since the financial situation in agricultural sections throughout the Middle West is not so good as was expected, dealers in farm-lighting plant units there are rather divided in opinion as to 1922 prospects. Sales for the past few months have increased only slightly over sales during the spring of the year. However, several dealers tell of an increased amount of inquiries even in territories where conditions are the worst. Such an interest shown at the present time augurs well for these units when farmers are on a better financial basis. In the majority of cases dealers are not heavily stocked, and when a few orders are obtained it is often necessary to send direct to the factory for them.

Sales in St. Louis and the Southwest for the past few months have been much better than was anticipated, but the decline in prices on farm products has held back a good many purchasers. Total sales for the year will be perhaps 25 per cent of those for last year. At the present prices of grains and meats, farming is not very profitable, and many farmers are in bad shape financially. Their losses, however, have been to some extent liquidated, and with labor prices lower they may have more buying power next year. This cannot have much effect until next summer, and as a consequence sales from now until spring will necessarily be slow and difficult. Dealers are getting out special advertising and making strenuous efforts to sell, so that a reasonable volume of business, considering existing conditions, may be expected.

In surveying the business of the present year on the Pacific Coast it appears that for about a year beginning with November, 1920, there was a decided slump in sales, though not in interest, for never before have there been so many live inquiries from prospective purchasers as during this time. Agricultural conditions have been excellent. Sales last month picked up surprisingly, going ahead of the same month last year. The average plant sold in this territory is now rated at 1½ hp. or 1¾ hp. It is noticeable that larger batteries are being demanded. One firm marketing 90-hour and 180-hour continuous-rating batteries reports more sales of the larger size. Manufacturers' stocks are very good, but dealers are buying more and more in a hand-to-mouth manner because of the uncertainty of prices.

Metal Market Situation

CONSUMING demand for copper has become very quiet, but producers are in a position of such great statistical strength that the lack of demand has no effect on price. Quotations of 13⅞ cents per pound rule for deliveries through December and January, but some producers say there is virtually no metal available at this price. There is authority for the statement that the copper surplus of the country is almost gone. It is true that there is still 200,000,000 lb. available for domestic delivery, but most of this is sold for the first quarter. Several of the larger agencies whose producing sources have had their mines shut down are said to be very low on unsold metal. From this it may be seen that there is a probability of a shortage and a runaway market, as it takes from three to five months between the mining of the copper and its delivery refined and most of the producers are entirely inactive.

NEW YORK METAL MARKET PRICES

	Dec. 12, 1921	Dec. 19, 1921
Copper	£ s d	£ s d
London, standard spot	66 17 6	66 12 6
	Cents per Pound	Cents per Pound
Prime Lake	13.75	13 87½
Electrolytic	13.62½	13 62½—13.75
Casting	12.87½	13.00
Wire base	15.00—15.25	15.00—15.25
Lead, Am. S. & R. Co. price	4.70	4.70
Antimony	4.50	4.50
Nickel, ingot	41.00	41.00
Sheet zinc, f. o. b. smelter	9.00	9.00
Zinc, spot	5.15—5.20	5.20—5.25
Tin, Straits	33.50	33.50
Aluminum, 98 to 99 per cent	19.00	19.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	11.50—11.75	11.00—11.50
Brass, heavy	5.00—5.50	5.00—5.37½
Brass, light	5.00—5.12½	5.00—5.12½
Lead, heavy	3.75—4.12½	4.00—4.12½
Zinc, old scrap	2.50—2.75	2.50—2.75

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

THE last week has been a period of hand-to-mouth buying for both the jobber and the dealer, and not until the taking of inventory has banished the fear of large stocks may better business be expected. If it were not for a fairly good holiday-goods demand and unprecedented December construction, business in all branches of the trade would have been negligible.

In spite of the dull tone, there are a few high spots. Makers of small electrical specialties around Boston are busy and there have been very good sales of air heaters there. Atlanta notes a demand for electrical toys much improved over the first of the month, but there still is fear of a carry-over. Excellent sales of radio receiving sets continue in Chicago, and there is the usual activity in high-tension equipment there. There are a number of small transmission lines under way or planned near St. Louis. On the Pacific Coast around San Francisco there is reported a rather disappointing end to holiday business.

NEW YORK

In the electrical trade particular attention has been given to the holiday business during the past week. As predicted earlier in the season, most dealers have waited until the last possible moment before ordering their Christmas stocks. As a result this business has been very active within the past week, and some jobbers report that their stocks of some heating appliances are very low. In some quarters it is expected that the volume of holiday sales will equal and possibly exceed that of last year, while in others the estimates are not so sanguine. It seems certain, however, that this business will be considerably in excess of early estimates.

Demand for wiring material is steady, with, of course, a tendency on the part of contractors to hold their stocks down until after the inventory period. There is a general tendency to mark time until after the turn of the year, when renewed activity is expected with a considerable degree of confidence.

Conduit.—There has been little change in the demand for this material, the additional 5 per cent discount announced last week appearing to have no tendency to stimulate sales. Under the new discount representative jobbers' quotations are: For ½-in. black pipe in 2,500-ft. lots, $46; ¾-in., $59, and 1-in., $85 per 1,000 ft. Galvanized pipe in the same sizes is quoted at $51, $66 and $94 per 1,000 ft. Jobbers' stocks are good.

Rubber-Covered Wire.—Prices have stiffened slightly during the past week, although demand remains about the same. No. 14 rubber-covered is quoted from $6.50 up to $6.93 per 1,000 ft. in 5,000-ft. lots.

Flexible Armored Conductor.—Jobbers have been able to increase their stocks somewhat, but the demand continues very active. Prices are a little easier. No. 14, two-wire, single-strip, is quoted at $45 per 1,000 ft., and double-strip at $47 per 1,000 ft.

Lamp Cord.—No change in price has been announced as yet. No. 18, cotton, twisted, is quoted at $12.90 per 1,000 ft. and the parallel at $15.60 per 1,000 ft. in that quantity. Stocks are good to large.

Heating Appliances.—Orders have been very good for the past week, and some jobbers who ordered sparingly are finding their stocks already depleted. There has been a heavy last-minute rush of holiday business which will probably continue through the present week.

Cleaners and Washers.—Jobbers report a very satisfactory volume of vacuum cleaner sales along with the other Christmas business. Washing machines are moving slowly.

B-X Connectors.—An advance of about 10 per cent in the price of these fittings has been announced. In lots of 1,000 the net price has been advanced from $36 to $40 per 1,000.

CHICAGO

Although wiring materials are moving steadily, the outstanding feature of the week has been the start of active Christmas trade. Dealers in general are satisfied with the good start Christmas buying has made and are optimistic as to the final total sales. Heating appliances, especially ironers, toasters and percolators, are going well; but the keen appreciation of price values is still felt by the public and results in sharp competition among dealers. The interest aroused by broadcasting grand opera is still sustained and some excellent sales have been obtained on radio receiving sets. A high-tension manufacturer announces a sale of a 1,200-kw. substation for a dredge on the Mississippi River and states that the power is obtained from a transmission line running along the river banks.

Wire—No remarkable change either in activity or volume has been noticed this week in wiring materials. However, the steady movement has been sustained. No. 14 rubber-covered still is quoted at about $6.60 per 1,000 ft. in 5,000-ft. lots. Weatherproof varies from 16⅝ cents a pound in 1,000-lb. lots to 16¾ cents, according to conditions of sale. The base on bare wire is 16¾ cents.

Flexible Armored Conductor—This is also holding a steady market with ample stocks on hand to supply the trade. No. 14 two-wire double-strip sells between $45 and $47 per 1,000 ft. in 5,000-ft. lots.

Conduit—Trade in conduit remains about on the same level it held during the last few weeks—that is, a fair but steady movement. Stocks are large enough to supply the needs of consumers. Black pipe in the ½-in. size sells for about $46 per 1,000 ft. in 5,000-ft. lots.

Poles—The 10 per cent reduction on Northern white cedar had little effect on the buying market of this territory. Although a few orders for replacements have been reported, the majority of dealers feel that this equipment will not be very active again until next spring.

Radio Equipment—Dealers report marked interest and good sales on receiving equipment due to the broadcasting of grand opera. Complete sets ranging from $30 to $50 seem to be the most popular.

Lamps—Activity on lamps still continues and dealers report the gas-filled lamps to be very popular. Movements of 75-watt to 100-watt lamps for industrial purposes have been noted. Demand for the blue gas-filled bulbs has increased.

Dry Cells—The call for dry cells has not increased very materially for the Christmas season, but jobbers report a fairly steady movement on this line. In barrel lots of 100 they cost about $31 to $33.

Heating Appliances—Christmas activity on these appliances has started and the general purchases are toasters, ironers, percolators and waffle irons. Dealers report stocks sufficient to cover the trade.

BOSTON

Conservatism in buying continues to dominate the trade, pending the completion of inventories and the turn of the year. Underlying financial conditions are maintaining their improved tone, and general industry is looking forward to better business after the holidays. In the textile field, mills are extremely active, fair business is being handled by shoe factories and makers of smaller electrical specialties are busy. The paper trade is quieter and metal-working plants are reviving but slowly. Good weather permits the continuance of building operations on a considerable scale. Central-station companies are busy on service repair work,

but before long a renewed activity in the installation of new services is likely to be seen, these having been greatly curtailed as a result of the November sleet storm. Hand-to-mouth ordering by jobbers and by contractor-dealers continues. The indications are that a fair holiday trade in the less expensive electrical conveniences will be recorded.

Wire—Rubber-covered No. 14 sells at $6.75 per 1,000 ft. in 5,000 ft. to 25,000 ft. lots, prices being open beyond the latter quantity. Shipments are coming in well from the factories, and even the present moderate building construction total absorbs large quantities of this material. Little bare copper wire is moving except for telephone toll service. Weatherproof is dull this week.

Fuses—Recent price fluctuations have disturbed the market not a little. Plug fuses in lots of 500 up to 30-amp. rating are selling through a range of 2¾ to 3½ cents net. Light demand is reported, with liberal stocks. With discounts running up to 70 or 80 per cent off list in some cases and wide differences among manufacturers as to quotations, conditions are very unsteady. A firmer tone is anticipated soon.

Lamps — Portable lamps are active in the retail field. General lamp business holds up well and deliveries are excellent. The temporary recession in consumption caused by interrupted service in outlying districts where central-stations were hard hit by the recent storm is not likely to make much of a "dent" in sales.

Motors—Little more than "pick-up" business is apparent in the motor field this week, but small order installations are going in constantly and helping to "sell" the motorization idea to industrial and mercantile concerns. Stocks are very representative and industrial betterment requirements are being readily met.

Rigid Conduit—Prices are steady, with spotty demand. Stocks are not very heavy, and ordering is confined chiefly to needs plainly in sight. Building operations have not yet increased to a point which strains the local supply to any extent.

Radiators—These units are being actively featured in the holiday trade, and sales are distinctly encouraging. Plentiful supply is noted.

Washers and Cleaners—A few washers are moving and cleaners still keep up a fair flow into the hands of retailers, but nothing striking characterizes this trade except very acute competition for business. Close attention to service is a factor in today's washer sales. Intensive canvassing is yielding some returns, but buying cannot be called good.

Hollow Ware—Socket appliances for the table and boudoir are in considerable demand. Jobbers are not buying much for stock and there are no general indications of a shortage of any type so far, although some makes of heating equipment were pretty well moved out of stock at the beginning of the week.

ATLANTA

As was to be expected, the volume of business in jobbing lines has fallen off during the past week on account of purchasers desiring to reduce stocks to a low figure for inventory. The retail business, however, reports considerable activity, especially in the holiday goods line. Specialties are moving better than was anticipated two weeks ago and with a little cold weather will show even better results within the next ten days. Building activities throughout the section continue to furnish a very fair volume of work for the electrical contractors, but keen competition has served to reduce the margin of profit so low in some cases that jobs are being taken at what amounts to a net loss. Construction in Atlanta continues very brisk, permits for the first two weeks of December amounting to $322,000, divided among 128 jobs. All indications point to the total for the year exceeding $11,000,000. Some pessimism is expressed regarding the outlook for the first sixty or ninety days of the new year on account of the government's estimate of the cotton crop, the fear being that this estimate will cause another break in the price of cotton. Should the break occur, general business will suffer accordingly. Some disappointment over the citrus crop in Florida is to be noted, the storm of several weeks ago having caused a large amount of the fruit to be dumped on the market, thus breaking the anticipated price.

Meters—A very satisfactory volume of business is reported, especially in the 5-amp. and 10-amp., two-wire sizes. One of the largest jobbers reports a growing tendency in the larger centers to purchase an increasing proportion of their meters in the 10-amp. size. Stocks are in good condition throughout the line.

Distributing Transformers—Some increase in the volume of sales is to be noted, the demand coming from all over the district generally for the 5, 7½ and 10-kw. sizes. A price reduction of 7 per cent became effective on Dec. 12. Local stocks are in good shape.

High-Tension Transformers—Quite a number of satisfactory orders have been received for apparatus of 11,000 volts to 66,000 volts, while an increasing number of inquiries are also being received, the sizes varying from 50 kva. to 1,500 kva. Shipments are from stock to 12 weeks.

Electric Toys—The poor outlook of two weeks ago has been replaced by a brisk demand for the more moderate-priced electric toys, such as ranges, washers and trains. It is anticipated, however, that even at the present rate there will be a carry-over in this line. There have been some sharp price reductions within the past ten days.

Sewing Machines—This line continues inactive, despite price reductions and dealers' efforts to move their stocks. Little renewed activity is expected before early spring. All jobbers have good to heavy stocks on hand.

Vacuum Cleaners—There is quite a noticeable Christmas demand for this article, especially in the moderate-priced machine. Sufficient quantities are on hand to satisfy requirements, while shipments are reported good.

Christmas Tree Outfits—Sales in this line are quite satisfactory, though there is considerable price cutting by some firms who allowed themselves to overstock, some sixteen-light sets being offered to the consumer as low as $3.50 per set.

Hollow Ware—All jobbers in this section report brisk sales in this line for the holiday trade, refill orders having begun to be quite in evidence. Stocks are on hand in sufficient quantities to meet the demand.

ST. LOUIS

Industrial construction work is gradually and consistently assuming larger proportions, but a vast amount of construction of all kinds still awaits a settlement of labor and material prices. A vote is now being taken by the various craftsmen on a general wage reduction from $1.25 to $1 per hour, and if an affirmative decision is reached construction work on a large scale will be opening in a very few months. Building permits for the city of St. Louis were less in November than in any month since March, being $975,125, of which $75,000 was for five new manufactories and workshops. However, the amount compares favorably with that for the same month of last year, which was $525,730.

Municipalities are not making extensive changes in their electric systems, though quite a bit of work is under contemplation. The difficulty lies in an aversion to additional bonded indebtedness, as taxes have been materially increased with the establishment of higher valuations, and business in the smaller communities is dull because of adverse agricultural conditions. The utility companies, however, are securing additional capital and are steadily making plant additions. Several small transmission lines in this territory are now under construction and many more are being actively considered. Manufacturers are increasing their production, but are slow in making changes or additions of magnitude to their equipment, pending more active business conditions.

Wire—Considerable variation is found in prices of rubber-covered, depending on the make of the wire handled. Quotations on No. 14 vary, in 10,000-ft. lots, from $6.25 to $6.87 per 1,000 ft. Stocks are in good condition and a reasonable demand continues. The base price on bare is 15 cents per pound and that on weather-proof is 15½ cents per pound.

Safety Switches—Some report that business is good and others that it is very dull. The industrial types are moving slowly, but there is a good demand for entrance types.

Flashlamps—The demand has been exceeding the supply of the spotlight type of flashlamps. Stocks this week are satisfactory, but difficulty has been experienced in getting sufficient shipments from the factories. Sales of flashlamp batteries are strong. A new type of unit cell is finding especial favor.

Dry Cells—The railroads are well stocked from the heavy buying at the time of the threatened strike, but nevertheless the demand has remained strong. Stocks are slightly low. The regular is priced at 31 cents and the igniter at 32 cents, both in barrel lots.

Tubes—Sales are improving and stocks are in good shape. The 2½-in. size is priced at $5.75 per 1,000 in barrel lots.

Lightning Arresters—Good sales obtain in the compression type, especially for 2,300-volt circuits. Several small transmission line extensions are under way in southern Illinois and inquiries are being received for a number of others in the territory. Stocks are in line with the requirements.

Motors—No appreciable increase in demand has been noticed as a result of the recent price reductions in three-phase motors, but an increased interest in the conversion of belt-driven plants to electric drive is developing as a result of the lower costs.

SEATTLE—PORTLAND

Merchants report many shopping but fewer buying than usual at this time of the year. Purchases are more for the necessities than for luxuries. Lumber production continues somewhat below normal, being 14 per cent low for the week ended Dec. 10. Shipments for the same week showed a material decrease, amounting to 28 per cent below production. New business, however, was only 11 per cent below production. The lumber business for 1921 shows a remarkable increase over that of 1920, especially as regards shipments to Japan, which it is estimated will reach 200,000,000 ft. as compared with 77,000,000 ft. for 1920 and 39,000,000 ft. in 1919. Rumors are current that several large orders have been placed with Northwest mills which will create a very heavy demand for the spring. Electrical jobbers are well satisfied with the progress which business is making toward normal. They report a satisfactory market in most lines and in specialties which are most affected by the Christmas demand. In many cases the past week's sales have exceeded expectations. Retailers of Seattle were unusually timid this year in the matter of laying in stocks of Christmas goods. They purchased sparingly in order to avoid overstocking, and as a result of this policy many of them and some jobbers are already sold out in certain lines and a shortage exists which cannot be met. Some lines of jobbers' stocks in Portland are running very low, but other jobbers are well supplied in these lines, and it would seem that unless there is an unusual last-minute demand local stocks can be depended on to take care of the Christmas business.

There is a slight upward trend in prices on some materials. The cost on standard and carton package quantities of switches, switch plates, conduit boxes, etc., remains practically unchanged, but on these same articles in less than carton lots certain advances have been made which means that hand-to-mouth buying on the part of contractors and dealers will be more expensive than it has been and they will necessarily have to cut their profits and add the increase on to the customer or buy in somewhat larger quantities. This will probably have the effect of eliminating somewhat the short buying which has existed for some time.

Wire.—The movement in rubber-covered wire has been very satisfactory and prices have remained steady during the past week. Stocks are good. No. 14 is quoted at $7 per 1,000 ft. in 5,000 ft. lots. Seattle quotes No. 12 at $9.20 and Portland at $10.20 per 1,000 ft. in 5,000 ft. lots. Weatherproof-wire prices have stiffened and demand is good. No. 6 is quoted at $19 and No. 8 at $20 per 100 lb.

SAN FRANCISCO

The dry weather has enabled building to be carried on without interruption, Los Angeles maintaining its high record and San Francisco steadily recovering from its mid-season slump. Architects claim to have estimated much work so far unreleased, so that a good start for 1922 is assured. Rain is urgently needed because the soil is dry and hard.

Lamp Cord—New lamp-cord prices are in the nature of a general adjustment, a slight increase in silk and reinforced being noted with a 10 per cent decrease in cotton-covered. The following prices will give an idea of the market: No. 18, cotton-covered, twisted, $12 per 1,000 ft.; No. 18, silk, twisted, $28.50 per 1,000 ft.; No. 18 cotton, reinforced, $24 per 1,000 ft.; all for coil lots, the maximum quantity scheduled. There has been a sharp increase in the demand for No. 18 cotton-covered, which has cut down stocks.

Conduit.—A decrease of about 5 per cent has been registered, ½-in. black now selling for $6.25 per 100 ft. and galvanized for $6.75 per 100 ft. in 10,000-ft. lots, with carloads 5 per cent lower. The call is better, but local stocks are so far entirely adequate.

Boxes and Covers—Here increase is noted, the new discount being 40 per cent on galvanized, which is 10 per cent higher than previously. This price is for 1,000 pieces assorted in standard packages. Such orders are rather rare, the usual sale being in packages for a few stock sizes at an advance of 10 per cent.

Tapes—Commercial friction rubber tape is quoted at 39 cents per pound. Nearly all the demand is for 50 lb. or smaller quantities at an advance of 10 to 15 per cent. The sudden increase in call reduced some of the jobbers' stocks to the emergency buying point. Tape stock is a good barometer of demand because at this distance from the point of manufacture it is manifestly unwise to stock beyond the demand or legitimate expectations of an increased demand.

Holiday Goods—A disappointing cessation to what appeared to be the promise for a brisk holiday season is reported. It is a fact, however, that holiday business in all lines will be below last year's sales and that electrical goods are more than holding their own when the proportionate rate of decrease is figured. Smaller devices and Christmas tree outfits make up the bulk of the call.

SALT LAKE CITY—DENVER

The past week was somewhat disappointing in volume of pre-Christmas sales. Luckily for the electrical dealers, buyers are turning more to useful gifts and electrical appliances are having a fair run. A seasonable snowstorm has come to the intermountain country and is being counted on as a stimulator of holiday business. A cold wave has halted outside concrete work, and as a result building is continuing only on the inside. It is declared that prices of lumber and building hardware have finally hit the bottom and that this stabilized condition will promote construction in the spring. The average price of lumber was about 70 cents in 1920. It has now dropped to about 50 cents.

Banks are gradually acquiring more funds available for loans, and the tendency to force liquidation on their debtors is growing less marked. As the year draws to a close business in the Mountain States is congratulating itself on the comparatively small number of failures. Some sections have been hard hit and are just now struggling through the most critical period. There is a certain widespread and general improvement, however. Public confidence in a better future for business and returning prosperity is reflected in a sustained revival of bond buying. Prevailing retail prices on electrical merchandise are about as follows: Percolators, $10 and up; curling irons, $6.25 and up; electric sewing machines, $58 and up; washing machines, $80 and up; heating pads, $6.75 and up; toasters, $6.75 and up; electric irons, $6.75 and up; grills, $12.50 and up. Vibrators are quoted as low as $4.29. Toy trains and Christmas tree lighting units are moving well. Dealers are stocking only as their needs require. There is evidence of considerable uncertainty about the future of prices.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Torrington Reports Heavy Demand for Cleaners

A phenomenal increase in electric vacuum-cleaner sales is reported by the Torrington Company, Torrington, Conn. G. Q. Porter, general manager of the company, recently issued the statement that orders to date for the present quarter are 270 per cent of those to the corresponding date of the previous quarter. Billings of the company showed a 30 per cent increase over the quarter before. Mr. Porter attributes much of this improvement in business to more intensive sales efforts, coupled with the offer of free attachments with each cleaner, a feature which was not in effect during the previous quarter.

Lighting Fixture Council Wants Slogan

A contest for a slogan which will best epitomize the benefits of lighting has been inaugurated by the National Council of Lighting Fixture Manufacturers. This movement was started by E. F. Guth, president of the St. Louis Brass Company, and the executive committee of the National Council has offered prizes of $100 for the best slogan and $50 for the next best. The desire of the council is to have a motto which will express in a few words the value of good lighting in the home and in the social and business life of the country.

St. Louis Electrical Men Prepare for Show

The executive committee of the St. Louis Electrical Board of Trade has decided to form a corporation for the actual management of and responsibility for the electric show to be held there. The first board of directors of the corporation is to consist of C. E. Michel, J. S. Tritle, J. N. Goodell, H. D. McBride and E. J. Spencer. The name of the corporation is to be the St. Louis Electrical Board of Trade Exposition Company.

Yale & Towne to Have German Plant

The Yale & Towne Manufacturing Company, manufacturer of locks, builders' hardware and material-handling equipment, such as electric industrial tractors, has announced that it will soon establish a factory in Germany to avail itself of the low production costs prevaling in that country and in an effort to regain its foreign business, which has been practically wiped out on account of the war. Peter F. Augenbraun, who for years has been a department head in the Stamford plant, will have charge of the German plant, which is to be established near Hamburg.

"A recent investigation," the statement of the company says, "has indicated that the cost of production in Germany is so much lower than in the United States that it is hopeless at this time to compete in many foreign markets with goods of American manufacture."

The entire line of the company will continue to be exported for some time. German manufacture of the company's electric industrial tractors is not contemplated immediately, and the principal products of the new plant for the time being will be blocks and hardware.

Duquesne Electric Buys Plant It Has Occupied

The Duquesne Electric & Manufacturing Company, Pittsburgh, rebuilder of electrical machinery, has bought the plant, site and buildings in the East Liberty industrial district, which it has occupied for the past five years. Besides this property, it has acquired 22,000 sq.ft. of ground adjoining the plant for expansion purposes. The company is completely equipped for handling electrical machinery of any size, the plant being on a railroad and fitted with electric cranes. It is the intention of the company to erect an additional building on that part of the property at Hamilton Avenue and Broad Street.

Ford Company Orders Largest Electric Furnace

The Ford Motor Company, Detroit, has ordered from the Electric Furnace Construction Company, 908 Chestnut Street, Philadelphia, the largest electric melting furnace ever designed. The furnace is of 9,000-kva. capacity and is designed with six electrodes. The bottom is of the "Greaves-Etchells" bottom-conducting type, similar to those already installed and on order for the company. This furnace is to be the principal melting unit of the new battery of electric furnaces being put down at the Ford Company's River Rouge works.

Friction Tape Market Outlook Brighter

Signs of increasing confidence in the friction tape market are apparent and the outlook for next year is very promising, according to a statement to a representative of the ELECTRICAL WORLD by P. G. Alexander, manager tape department, Boston Woven Hose & Rubber Company, Cambridge, Mass. Business began to pick up well in September and with some fluctuations has continued to hold good gains since. Jobbers are buying somewhat more freely, although purchases for distributers' stocks are not very active as yet. Considerable scattered building is being done and this absorbs increasing production. Some manufacturing is being done for factory stocks in order to make prompt shipments. Mr. Alexander said that orders from abroad are gaining somewhat, Australia and other points having made commitments regardless of the exchange situation. Raw materials are more costly than earlier in the year, and some stiffening in prices is not unexpected.

Anaconda Copper and American Brass Announce Plans for Merger

Will Be Union of Largest Producer and Largest Consumer in World—Plan Approved Subject to Working Out Details

Plans for what is thought to be one of the most important mergers affecting the electrical industry in some years were announced last week when large stockholding interests of the Anaconda Copper Mining Company and the American Brass Company met in New York to discuss a merger of the latter company with the Anaconda company. This will be accomplished, according to John A. Coe, president of the brass concern, through the offering to American Brass shareholders of an opportunity to obtain in the near future an option to dispose of their holdings to the Anaconda company at $150 cash per share and three shares of Anaconda. Figuring each share of Anaconda worth $50, the transaction will involve a total payment to American Brass shareholders of $45,000,000.

This offer, it was stated, will be conditional upon the deposit of at least 51 per cent of the outstanding American Brass capital stock. The period in which these shareholders may signify their assent to the deal will probably last through January.

There were present at last week's meeting stockholders approximating 40 per cent of the brass company's stock, and these representatives unanimously approved the merger plan, subject to working out of the details. A committee was formed for this purpose. If and when the consolidation is completed, the American Brass working organization will continue as at present.

The American Brass Company, it was stated by John D. Ryan, chairman of the board of the Anaconda company, is the largest single consumer of copper and zinc in the world, while the Anaconda is the largest single producer. American Brass in its peak year turned out 600,000,000 lb. of the metal, or 40 per cent of the country's entire output. Negotiations for the acquisition of the brass company have been going on for the past six months, he said, and a letter will soon be sent out to Anaconda stockholders, asking them to approve the transaction.

The merging of these two companies has been followed by talk of other copper mergers. The American Smelting & Refining Company, the Kennecott Copper Corporation and the Utah Copper Company are being mentioned together, while another group may include Inspiration, Magma, Calumet & Arizona.

Philadelphia to Have Foreign Trade Convention

The ninth convention of the National Foreign Trade Council, it is announced, will be held in Philadelphia May 10, 11 and 12, 1922. Previous meetings have been held in St. Louis, New Orleans, Pittsburgh, Cincinnati, Chicago, San Francisco and Cleveland. The aim of the convention, according to O. K. Davis, secretary of the council, will be partly to show that the foreign trade of the country must be expanded if the United States is to enjoy any real domestic prosperity, as since 1913 the capacity of American farms and factories has been so increased that our former "normal" exports are not nearly great enough to absorb the surplus over and above domestic consumption.

Holophane to Have Lighting Exhibits at Office

The Holophane Glass Company, Inc., has moved its New York office and showroom from its old quarters at 340 Madison Avenue to the Canadian Pacific Building at 342 Madison Avenue. The new office is illuminated scientifically, a uniform illumination of 10 foot-candles being obtained. The office is to be used as an exhibit of proper office illumination. Show-window-lighting exhibits have been installed for the benefit of electrical contractors.

Wilson Company Moves Plant to New York

The Wilson Welder & Metals Company, formerly at 253 Thirty-sixth Street, Brooklyn, recently moved its offices and factory to 132 King Street, New York. The company in its new location will have 15,000 sq.ft. of floor space for factory purposes, a considerable increase over its former plant. The move was made necessary by increasing business. Thomas B. Hasler has just been elected president of the company.

Intelligent Credit Hope of World, Banker Tells Credit Men

The intelligent extension of credit by America to the rest of the world is the best means to put industry back on a sound footing, according to Willis H. Booth, vice-president Guaranty Trust Company, who spoke at the annual dinner of the New York Electrical Credit Association on Dec. 14. America is now the credit center of the world, said Mr. Booth, and though the comparative inexperience of American bankers in international trade is a handicap, the job is ours and must be done intelligently. The first thing to do is to work for a restoration of a sound basis of credit rather than to attempt to solve the problem by inventing machinery for the use of credit, and to accomplish this America must help business in Europe and South America to get started by trading with them. Various South American countries, Mr. Booth disclosed, were on the verge of a trade breakdown last spring, which would have caused large losses to American manufacturers. The banks came to the rescue, however, and at present business there is gaining. Cuba still remains a bad spot.

The report of the secretary showed a large increase in number and value of overdue accounts reported, there being 4,080 reports with a value of $735,053, 28 per cent more than the previous year. However, 67 per cent of these were settled before it became necessary to post them. It was necessary to post 1,464 cases for $259,641, an increase over 1920 of 100 per cent in number and amount. Of these 80 per cent were finally settled. It will be seen that while payment of many accounts was delayed longer than in 1920, a satisfactory settlement was arrived at in a correspondingly large number of cases.

G. H. Potter, Sprague Electric Works, and W. J. Kranzer, Crannell-Nugent-Kranzer, were elected directors for a three-year term. Election of other officers was set for Dec. 21.

G. E. Billings Expected to Reach $220,000,000 in 1921

Billings of the General Electric Company for 1921 should reach $220,000,000, if the rate of billings averaged in the first nine months of the year continue until Jan. 1. This is approximately 80 per cent of billings in 1920, which totaled $275,758,000, or $43,000,000 under orders received. There is every reason to believe, the statement says, since the ratio has continued during the present quarter that net sales billed will actually reach $220,000,000.

Bookings for the first nine months of the year indicate an annual total of $180,000,000, which is approximately 60 per cent of the capacity of all the plants of the company. The company's unfilled orders on the books at the close of last year stood at $111,000,000. There was a margin of somewhat over $50,000,000 against which the company could operate over its booking rate. Unfilled orders are usually kept around $50,000,000.

Present conditions would seem to indicate that buying is again on the upward path. The company has pointed out in a recent statement that public utilities have funds in hand for expansion and that when they enter the field the manufacturing capacity of the company will not be in excess of what is necessary.

Benjamin Plans Dealer Aid Campaign

A plan of direct-by-mail advertising to prospects of contractor-dealers is being formulated by the Benjamin Electric Manufacturing Company, Chicago. Dealers are to be invited by the Benjamin company to submit lists of local "prospects," to whom the Benjamin company will send advertising matter direct, while at the same time calling attention to the fact that the particular contractor-dealer is carrying a stock of the products advertised.

Reasons for Prosperity Outlined by Laclede-Christy

In the thirteenth semi-annual chart letter got out by Laclede-Christy, St. Louis, are pointed out a large number of reasons why the year 1922 should see a return to a condition of stable prosperity. The letter asserts that business has always moved in up-and-down cycles and cites the good business following the slumps of 1903, 1908 and 1911 as proofs. It is logical, it continues, that 1922 is scheduled for a period of real activity.

Okonite Company Opens Atlanta Branch

The Okonite Company, Passaic, N. J., manufacturers of insulated wires and cables, tape and loom, has opened a branch office at 1513 Candler Building, Atlanta, Ga. The branch is to be in charge of John L. Phillips, while E. A. Thornwell will be Southeastern sales representative. The territory served by this office includes North and South Carolina, Georgia, Tennessee, Alabama, Florida and the city of New Orleans.

Habirshaw Company Explains Receivership Reasons

The present condition of the Habirshaw Electric Cable Company, Inc., and the reasons for the recent appointment of a receiver are given at some length in a statement published in the December *Wire Message*, the house organ of the company. Since last June, it is stated, loans have not been increased. Administration, operating and miscellaneous expenses have been reduced 58 per cent compared with last January. Business has increased in the meantime and most of the stock accumulated before the depression has been wiped out. A net profit has been made every month since and including last June, and each month has shown a substantial gain over the previous one. A rigid account of expenditures is being kept.

The Bridgeport plant is running double shift with enough work on hand and in sight to keep it running to capacity until March or April. The Glenwood plant is running at part capacity with seasonal improvement expected in February. The Dock Street plant has been closed all year and probably will not be reopened for some time. The bare wire plant is operating without loss.

The receivership, it is stated, was due to the inflation of the company's plant and facilities to supply the government with wire and to the wholesale cancellation of government contracts after the armistice, as well as to the slump in business during the past year. Confidence is expressed that the company will be back on its feet with the return of prosperity.

National Illuminating Appliance Changes Name

The Cook-Art Illuminating Products Corporation is the new name of the National Illuminating Appliance Company, 225 Fifth Avenue, New York. The factory of the company, formerly located at 255 West Forty-fourth Street, has been moved to 115 East Twenty-sixth Street, where it will have considerably enlarged quarters. The company manufactures art lamp shades and illuminating displays. M. K. Kassony is president.

The Bullock Manufacturing Company, manufacturer of lighting equipment and fixtures, has removed its plant from 408 West Thirteenth Street to 356-58 West Fortieth Street, where it will have approximately four times as much manufacturing space.

The American Electric Supply Company, 953 West Washington Street, Chicago, has awarded contract for a three-story concrete warehouse.

Foreign Trade Notes

RAILWAY TRAINS TO BE LIGHTED BY ELECTRICITY IN FRANCE.—The French government, technical journals report, has decided to eliminate the use of gas as an illuminant on railway trains. The Minister of Public Works and Transport, M. Le Trocquer, according to *Commerce Reports*, has issued a circular which decrees that after Jan. 1, 1923, no gas lighting will be permitted on express trains. On suburban trains electricity must be used for lighting after Jan. 1, 1924, and by the first of 1925 all trains operating in France must be electrically lighted. In 1914 the French government contemplated eliminating from trains all lighting except by electricity, but action was delayed by the war. Recent train wrecks, however, where cars were set on fire through ignition of gas following collisions, have brought the matter to a head and emphasized the risk incident to the use of gas.

BRAZILIAN COURT DECISION AFFECTS TRADEMARK REGISTRATION.—An important decision affecting trademark registration in that country has recently been handed down by the Brazilian Supreme Court. In writing on this subject Dr. R. P. Momsen of the Brazilian bar says that the court decided that international trademark registrations made in Berne, according to the Berne international convention, are not effective in Brazil unless full description of such registrations is published in the *Diario Official* (Official Gazette). A trademark in order to be effective in Brazil must be published in the *Diario Official* in the same way as Brazilian registration. The American merchant is not vitally interested in the Berne registrations, because the United States is not a party to the Berne convention. But as the decision reflects upon the validity of the registrations of trademarks at Havana, under the Buenos Aires convention of 1910, the matter becomes of vital importance to the American merchant. According to the Buenos Aires convention two inter-American trademark bureaus were provided for, one at Havana, to serve the northern group, and one at Rio de Janeiro, for the southern group. Registrations made at one bureau are transferred to the other, without additional registration, and become effective for the whole group of American republics. The Havana registrations, however, are deposited in Brazil under the same procedure as that of the Berne registration, that is to say, without publication. Therefore the decision of the Supreme Court denying the validity of a Berne registration for lack of publication, in so far as Brazil is concerned, equally denies the validity of the Havana registrations, which are deposited in Brazil in the same manner.

ELECTRICAL POWER FOR THE HUON DISTRICT, TASMANIA.—The State Hydro-Electric Department, according to the *Industrial Australian and Mining Standard*, has submitted an offer to supply electricity to various municipalities of the Huon district south of Hobart. The scheme provides for a high-tension main-feeder line to serve Kingston, Franklin, Huonville and Port Cygnet, to be delivered at each town at approximately 10,000 volts. Under the present plan the Councils would be called upon to provide the necessary transforming apparatus as well as the general distribution system for their respective districts.

AMALGAMATION OF ELECTRIC COMPANIES IN CHILE.—The Chilean Electric Tramways & Light Company and the National Electric Power Company, according to *Electrical Industries*, have recently consolidated, with a combined capital stock of £12,000,000.

NEW ELECTRIC PROJECT IN RUSSIA.—The Allmanna Svenska Elektriska Aktiebolaget, according to *Electrical Industries*, has been granted a concession to build an electric plant at Yaroslav on the Upper Volga.

HYDRO-ELECTRIC SCHEME FOR SOUTH ISLAND, NEW ZEALAND.—An examination of Lake Tekapo with a view of utilizing the water power to develop electricity has, according to *Electrical Industries*, been made by H. B. Hall of Timaru. He finds that, after leaving Lake Tekapo, the river takes a turn, and 3 miles from the outlet approaches the lake again and is only a mile from it. To tunnel this distance would give a fall of 80 ft., which, with a minimum lake discharge of 4,000 cu.ft. per second, would develop 30,000 hp. at the water turbines. He proposes aërial transmission at 55,000 volts via Mackenzie Pass (15 miles), and then 40 miles to Timaru. The cost of the tunnel, power house and transmission line is estimated at £400,000 and that of the distribution system to cover the entire district at £240,000. This is the first time Tekapo has been considered in connection with a low-pressure power scheme from the new lake.

PROPOSED CABLE BETWEEN ITALY AND BRAZIL.—Representatives of the Italian government, according to *Electrical Industries*, have announced that a cable between Italy and Brazil will be laid within two years. It is proposed later to extend the line to the Pacific Coast.

HYDRO-ELECTRIC PROJECT FOR NEW SOUTH WALES, AUSTRALIA.—The New South Wales Cabinet, according to *Electrical Industries*, has agreed to issue a loan of £80,000 in order to carry out the proposed hydro-electric project on the Clarence River, known as the Nymboida hydro-electric scheme, which will supply electricity to all the extreme north coast towns in the state.

GERMAN-AUSTRIAN ELECTRICAL MANUFACTURERS MAY COMBINE.—Austrians and Germans have been negotiating in Berlin for the formation of a sales company to exploit the German-Austrian electrical industry, according to a statement in the Vienna press reported by Charles H. Foster of the American Mission at Vienna. The headquarters of the new company will be in Vienna, and its capitalization will be 500,000,000 crowns. A wage contract for production is under consideration with the Berlin and Vienna electric companies, while the proposed sales company will attend to the actual disposition of the product of the two branches of the industry for their joint account.

ELECTRIC SYSTEM FOR SALE IN BEIRUT, SYRIA.—The electric and gas systems and franchises in Beirut, Syria, according to cable reports to the Bureau of Foreign and Domestic Commerce, are for sale. The enterprise consists of a 400-kw. electric generating plant, a gas plant (not now operating) and real estate. The electric franchise is for eighty-two years and the gas franchise is for sixty years. Further information may be secured from the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce by referring to exhibit No. 41,298.

ELECTRIFICATION OF RAILWAYS IN SOUTH AFRICA.—P. J. Stevenson, trade commissioner at Johannesburg, South Africa, has notified the Department of Commerce that the Railway Board has decided to go ahead with the electrification of the Durban-Glencoe line. The cost is estimated at £5,000,000.

EXTENSIONS PROPOSED TO ELECTRIC SYSTEM AT HELSINGFORS, FINLAND.—Negotiations are in progress between the city of Helsingfors and the South Finland Power Company, according to reports received by the Department of Commerce, looking to the development of additional water power which will enable the power company to deliver a minimum of 10,000,000 kw.-hr. annually. The present maximum output of the power company and the municipal steam plant, which have been interconnected, is only 6,000,000 kw.-hr. annually, which is inadequate to meet the increasing demand for electrical service.

New Apparatus and Publications

WIRE.—The Belden Manufacturing Company, Twenty-third Street and Western Avenue, Chicago, has developed a light, flexible and insulated contact wire for sign flashers.

TOASTER.—A reversible electric toaster has been placed on the market by Manning-Bowman & Company, Meriden, Conn.

INCUBATOR HEATER.—An electric heater that will fit any "Queen" incubator from 70-egg to 1,000-egg size has recently been developed by the Queen Incubator Company, Lincoln, Neb. The company also manufactures a similar device for use on chicken hovers.

FRACTIONAL-HORSEPOWER MOTORS.—The Calumet Motor Company, Lake Linden, Mich., has placed on the market several types of ¼-hp., 60-cycle, 110-volt, single-phase motors.

TIME SWITCH.—A time switch provided with a clock movement with a chronometer escapement has been placed on the market by the A. & W. Electric Sign Company, 2120 East Nineteenth Street, Cleveland.

AGITATOR DRIVE.—A motor-driven, direct-connected "Nett-Co" agitator drive has been developed by the New England Tank & Tower Company, Everett, Mass.

WIRELESS BATTERY.—The Hipwell Manufacturing Company, 831 North Avenue, West, Pittsburgh, Pa., has brought out a new refillable and variable B "Hipco" battery.

SEARCHLIGHT.—The Franco Electric Corporation, 60 Tillary Street, Brooklyn, N. Y., has developed a "3-in-1" searchlight, equipped with three flashlights.

DRILL.—A special half-inch drill with "the pistol grip and trigger switch" has been placed on the market by the Black & Decker Manufacturing Company, Towson Heights, Baltimore.

TRANSFORMER TESTING SET.—The Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, has brought out the Silsbee current-transformer testing set. This is a compact portable set for making precision tests of current transformers in position.

DRILLS.—The Hisey-Wolf Machine Company, Cincinnati, is distributing bulletin No. 105-A, describing the new "Hisey" super universal motor drills.

ELECTRIC FURNACE.—"When You Buy an Electric Furnace" is the title of bulletin No. 302 issued by the Repel-Arc Furnace Company, Indianapolis, describing the "Repel-Arc" furnace.

ATTACHING DEVICE.—The Cutler-Hammer Manufacturing Company, Milwaukee, manufacturer of electric controlling devices, has developed a new attaching device for portable electrical appliances.

WHITE LIGHT CONVERTERS.—The Wagner Electric Manufacturing Company, St. Louis, is distributing four folders describing the "Wagner" type S. C. and type O. S. white-light converters.

TERMINALS AND FUSE PARTS.—"Metal Stampings" is the title of an eight-page folder distributed by the Patton-MacGuyer Company, Providence, R. I., covering its wire terminals, cable lugs, fuse parts and special stampings.

New Incorporations

THE BUFFALO (N. Y.) ELECTRO-THERMO CORPORATION has been organized with a capital stock of $250,000 to manufacture electrical specialties. The incorporators are R. Anderson and C. T. and R. F. Penton, Ellicott Square.

THE S. A. V. COMPANY, Nutley, N. J., has been incorporated by Minard S. Smith, Norman K. Althouse and Ernest C. Van Winkle, 113 Myrtle Avenue. The company is capitalized at $125,000 and proposes to manufacture electrical appliances.

THE IDEAL APPLIANCE COMPANY, 266 Newark Avenue, Jersey City, N. J., has been organized to manufacture and deal in electrical appliances. James Cavolosi is interested.

THE HALLOWAY ELECTRICAL SUPPLY COMPANY, New York, N. Y., has been organized by H. A. Halloway, M. Comerford and I. Josephson, 1482 Broadway. The company is capitalized at $20,000 and proposes to manufacture and deal in electrical equipment.

HERBERT G. PECK, INC., Newark, N. J., has been incorporated with a capital of $5,000 to manufacture and deal in electrical devices. The incorporators are Herbert G. Peck and Henry Durna, 786 Broad Street.

THE ATLAS ELECTRIC COMPANY, 123 Franklin Street, Union Hill, N. J., has been organized to manufacture and deal in electrical equipment. William Goodman is interested in the company.

THE UNEEDA LIGHTING FIXTURE COMPANY, 580 Newark Avenue, Jersey City, N. J., has been incorporated with a capital stock of $10,000 by Joseph Panchelft, Michael Tozzi and Joseph Marosem.

THE KINGSVILLE (OHIO) ELECTRIC LIGHT & POWER COMPANY has been organized with a capital stock of $35,000 by F. D. Comp.

THE DELTON (WIS.) ELECTRIC COMPANY has been incorporated with a capital stock of $5,000 by S. S. Squires, A. M. Reynolds and Otto Timme, Delton.

THE ELIZABETHTOWN (IND.) POWER & LIGHT COMPANY has been incorporated by W. H. Newson, B. W. Parker, J. M. Cox, G. O. Cosby and D. M. Branham. The company is capitalized at $10,000 and proposes to generate and distribute electricity.

Record of Electrical Patents

Notes on United States Patents

(Issued Nov. 22, 1921)

1,398,213. BATTERY; David H. Wilson, Philadelphia, Pa. App. filed May 2, 1919. Large active area of electrodes.

1,398,217. ELECTRIC HEATER; Edmund N. Brown and Milton H. Shoenberg, San Francisco, Cal. App. filed Oct. 2, 1919.

(Issued Nov. 29, 1921)

15,241 (reissue). CONDENSER AND METHOD OF MAKING THE SAME; Albert Pruessman, East Orange, N. J. App. filed July 27, 1917. To prevent permanent change in electrical constants as result of temperature changes.

1,398,228. ATTACHMENT PLUG; Bertram J. Grisgby, Chicago, Ill. App. filed Jan. 12, 1918. Prevents pull on terminals and kinking of cord.

1,398,247. APPLIANCE FOR HOLDING FILMS FOR DENTAL RADIOGRAPHS; Thomas B. S. Wallace, Chicago, Ill. App. filed Feb. 24, 1920.

1,398,266. ELECTRICAL INDICATING AND MEASURING DEVICE; Harry W. Hitchcock, New York, N. Y. App. filed April 7, 1920. To indicate component frequencies.

1,398,287. SELECTIVE SIGNALING SYSTEM; George K. Thompson, Maplewood, N. J. App. filed Jan. 15, 1920. Multi-station telephone lines.

1,398,358. BATTERY COVER; Glenn J. Bundy, Detroit, Mich. App. filed June 29, 1918. Terminal construction.

1,398,366. DRY CELL; Harold De Olaneta, New Haven, Conn. App. filed Sept. 2, 1919. Method of sealing.

1,398,372. COIL MOUNTING; Robert F. Gowen, New York, N. Y. App. filed July 23, 1920. Radio inductance coils.

1,398,391. AUTOMATIC TELEPHONE SYSTEM; Winfred T. Powell, Rochester, N. Y. App. filed July 28, 1919. Service-charging device.

1,398,404. DISK-SHAPED COMMUTATOR FOR GYROSCOPE MOTORS; Hermann Sundhaussen, Essen, Germany. App. filed Jan. 15, 1921.

1,398,410. EMBEDDING PROCESS; Edwin L. Wiegand, Pittsburgh, Pa. App. filed June 21, 1920. Electrical heating devices.

1,398,515. SYSTEM OF CONTROL FOR INDUCTION MACHINES; Rudolf E. Hellmund, Swissvale, Pa. App. filed May 15, 1917. Simply, efficiently and effectively accelerated.

1,398,518. FLASHLIGHT BATTERY; Harry H. Hipwell, Pittsburgh, Pa. App. filed Nov. 16, 1920. Core manufacture.

1,398,526. ELECTROMAGNETIC APPARATUS INTENDED TO MAGNETIZE PERMANENT MAGNETS; Antoine Luzy, Paris, France. App. filed Nov. 22, 1919.

1,398,542. ARRANGEMENT OF HEATERS IN ELECTRIC OVENS; Frank F. Forshee, Flint, Mich. App. filed Dec. 13, 1919. Uniform heat.

1,398,545. MERCURY LAMP; Henri George, Paris, France. App. filed April 4, 1919. Started without rocking and may be operated on alternating current.

1,398,589. TELEPHONE-EXCHANGE SYSTEM; Clarence B. Fowler, New York, N. Y. App. filed Nov. 19, 1920. For connecting common-battery toll switchboard with magneto switchboard.

1,398,593. ALARM SYSTEM; Richard M. Hopkins, Rutherford, N. J. App. filed March 29, 1920. For use in banks.

1,398,594. TRANSMITTER; Richard M. Hopkins, Rutherford, N. J. App. filed March 29, 1920. Employed in alarm systems.

1,398,595. MEANS FOR CALIBRATING AMMETERS; Adrian H. Hoyt, Penacook, N. H. App. filed June 7, 1920. Without disassembling.

1,398,605. COMPRESSION RHEOSTAT; Thomas Spooner, Pittsburgh, Pa. App. filed May 14, 1920. Blocks of resistance material and radiating plates maintained in uniform contact.

1,398,620. PROTECTING DEVICE FOR MULTIPHASE ALTERNATING-CURRENT APPARATUS; James R. Beard, Newcastle-Upon-Tyne, England. App. filed Oct. 9, 1917. Balanced relays.

1,398,630. ELECTRICAL RESISTANCE APPARATUS; Philip H. Dawe, London, England. App. filed Aug. 25, 1917. Resistance is flowing liquid.

1,398,656. POWER-TRANSMITTING MECHANISM; William A. Stevens, Maidstone, England. App. filed Sept. 24, 1918. For motor vehicles, rolling mills, etc.

1,398,658. PROCESS FOR EXTRACTING GASES FROM LIQUIDS; Frank S. Vincent, Grand Rapids, Mich. App. filed Jan. 13, 1919. Oxygen and hydrogen from water.

1,398,665. THERMIONIC AMPLIFIER; Harold D. Arnold, Maplewood, N. J. App. filed Jan. 8, 1920. Three-element type.

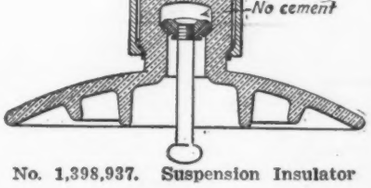
1,398,687. THERMOPHONE; Budd D. Gray, Greenwich, Conn. App. filed Feb. 19, 1920. Economical to make and easy to repair.

1,398,728. VOICE-CURRENT TELEPHONE REPEATER; George H. Kuhl, Chicago, Ill. App. filed May 31, 1919. Method of reversing or switching amplifier.

1,398,736. HANDLAMP; Arthur P. Paine, New Haven, Conn. App. filed April 2, 1921.

1,398,784. ELECTROLYTIC CELL; J. Cranston, Trenton, N. J. App. filed Oct. 19, 1920. Production of chlorine and alkaline liquor.

1,398,792. PRESSURE-GAGE LOG; Josua G. Paulen, Stockholm, Sweden. App. filed April 10, 1918. For indicating speed and distance.



No. 1,398,937. Suspension Insulator

1,398,793. INDUCTION COIL; Glen Peplinski, Mohawk, N. Y. App. filed Oct. 17, 1919. Primary and secondary coils side by side.

1,398,799. FLASHLIGHT; Adolph C. Recker, Oakville, Conn. App. filed Feb. 28, 1921. Lamp mounted on cell.

1,398,806 CURRENT COLLECTOR; Isaac D. Shipper, Philadelphia, Pa. App. filed Sept. 12, 1921. Two-wire trolley for trackless vehicle.

1,398,847. STORAGE-BATTERY CELL; Frank Engel, Niagara Falls, N. Y. App. filed Sept. 12, 1917. Means for ventilating.

1,398,848. WIRELESS RECEIVIN AND TRANSMITTING APPARATUS; James Erskine-Murray and James Robinson Biggin Hill, England. App. filed March 30, 1920. Receiving station can determine its bearing relatively to transmitting station.

1,398,856. METHOD OF FRACTIONATE DISTILLATION; Fritz Hansgirg, Grätz, Austria. App. filed Nov. 7, 1919. Distillation of oils.

1,398,866. ELECTRIC COOKING OR HEATING VESSEL AND APPARATUS; Clarence H. Lauth, London, England. App. filed Dec. 16, 1919. Heating current flows through shell of vessel.

1,398,867. ELECTRIC COOKING OR HEATING VESSEL AND APPARATUS; Clarence H. Lauth, London, England. App. filed Dec. 16, 1919. Heating vessel forms part of secondary circuit of transformer.

1,398,892. TELEGRAPHY; Herbert G. Dorsey, Granville, Ohio. App. filed Oct. 6, 1916. Multiple telegraphy.

1,398,903. ELECTRICALLY HEATED LIQUID HEATER; Clarence H. Lauth, London, England. App. filed June 16, 1920. Heating resistance is shell of vessel.

1,398,937. SUSPENSION INSULATOR; Max Carolus, Tetlow, Germany. App. filed Sept. 29, 1921. Cementless insulator in which major stresses in porcelain are compression stresses.

Construction News

Projects, Plans, Bids and Contracts Contemplated or Under Way

New England States

WOONSOCKET, R. I.—Plans have been filed by the Blackstone Valley Gas & Electric Company for the construction of a branch power house at Second Avenue and River Street.

THOMPSONVILLE, CONN.—The installation of an ornamental lighting system on Main Street is under consideration.

Middle Atlantic States

BINGHAMTON, N. Y.—Negotiations are reported under way for the erection of an electric transmission line from the Willow Point plant of the Binghamton Light, Heat & Power Company along the proposed Binghamton-Vestal Highway through Vestal, Appalachine and Owego to Nichols, a distance of 30 miles. The company also contemplates extending its line from the center of Chenango Bridge village highway eastward 2½ miles along the Chenango River to Port Crane and the erection of rural lines in the direction of Kirkwood and Hawleyton. The cost of the project is estimated at $200,000. Roy L. Peterman is vice-president.

OSWEGO, N. Y.—The Water Service Commission is considering the construction of a municipal electric light plant to cost about $90,000. J. A. Bensel is consulting engineer for the commission.

ROCHESTER, N. Y.—A resolution has been adopted whereby the Town Board of Irondequoit is requested to arrange for the installation of arc lamps on St. Paul Boulevard from the city line to Summerville. Charles F. Brooks is chairman of the boulevard light committee.

ROCHESTER, N. Y.—Bids will be received by Charles L. Cadle, Superintendent of Public Works Albany, until Jan. 4, 1922, for furnishing and installing two 2-ton electric overhead traveling cranes at the barge canal terminal at Rochester.

NEWARK, N. J.—Bids will be received by the Passaic Valley Sewerage Commissioners, 128 Market Street, until Jan. 3, 1922, for the construction of the Yautacaw pumping station, including superstructure and appurtenances, crane runway, electrical work, etc.

BELLEFONTE, PA.—The Hecla Park Association is planning to establish an electric plant in the park. It is proposed to utilize the water power of the "old mill" stream near the park grounds.

BRADDOCK, PA.—The City Council is considering the establishment of a municipal electric light and power plant in Braddock.

FRANKLIN, PA.—Arrangements are being made by the Titusville Light & Power Company for the erection of a high-tension transmission line from the local plant of the Citizens' company to Titusville. Bids have been asked for the poles for the line. The Titusville company plans to extend its lines to Hydetown and Pleasantville.

PHILADELPHIA, PA.—Bids will be received at the office of William S. Twining, director, Department of City Transit, 1211 Chestnut Street, until Dec. 28 for 13,660 ft. of underground electrical conduit in Kensington Avenue, Frankford Avenue and Bridge Street. (Contract 642, Frankford Elevated Railway.)

EASTON, MD.—Plans are under consideration by the Eastern Utilities Commission for the installation of a new turbine, engine and auxiliary electric equipment at the municipal power plant.

DANVILLE, VA.—Plans are under consideration for the installation of a steam turbine, additional boilers and accessories at the municipal electric power plant. The cost is estimated at $100,000.

WASHINGTON, D. C.—Estimates have been submitted to Congress by General Beach, chief of engineers, for the installation of a lighting system in Rock Creek Park. The cost is placed at $14,000.

North Central States

FLINT, MICH.—The Board of Education contemplates the construction of a one-story power house in connection with proposed school to be built in the Oak Grove district of Flint, and for which bids will be received until Dec. 28. Malcomson, Higginbotham & Palmer, 409 Flint P. Smith Building, Flint, are architects. A. J. Wildanger is secretary of the board.

CLEVELAND, OHIO.—A ordinance introduced in the City Council authorizing the expenditure of $100,000 for the erection of police stations, purchase of cable and other apparatus and instruments for the extension of the police signal system has passed its first reading.

LIMA, OHIO.—The Council has passed an ordinance requiring all electric light, telephone and telegraph companies to place certain wiring underground within a year. The cost is estimated at $1,000,000.

LIMA, OHIO. — The construction of a power plant at the Lima Woolen Mills, Inc., is under consideration.

PADUCAH, KY.—The Paducah Electric Company has plans under way for the construction of power cables from Paducah to southern Illinois for the transmission of electrical energy. Two methods are under consideration, one to erect the cable over the Burlington Railroad bridge between Paducah ferry and Metropolis, and the other to lay a submarine cable under the Ohio River. Alfred S. Nichols is manager of the company.

ELIZABETHTOWN, IND.—A company has been organized by William H. Newson and others, with a capital stock of $10,000, to furnish electricity in Elizabethtown and to farmers within a radius of 10 miles. Connection will be made with the Mineral Springs high-tension line of the Interstate Public Service Company.

INDIANAPOLIS, IND. — The Mutual Milk Company, Bethel Avenue and Minnesota Street, plans to build a one-story power house in connection with a proposed addition to its plant.

SOUTH BEND, IND.—Plans are being prepared for the construction of a one-story power station, 20 ft. x 50 ft., in South Bend, to cost about $45,000. W. W. Artingstall, 37 West Van Buren Street, Chicago, Ill., is engineer.

BURLINGTON, ILL. — The question of issuing electric light and power bonds is under consideration.

CARMI, ILL.—Plans are under consideration for the installation of an ornamental lighting system on Main Street. W. R. Archer, president of the Carmi Commercial Association, is interested.

COLUMBIA, MO.—Bonds to the amount of $760,000 appropriated at the last session of the Legislature for the construction of buildings at the University of Missouri has been released by the Governor. Of this amount $150,000 will be used for a new woman's building, $200,000 for a new agricultural building, $150,000 for a new power plant, and $125,000 for a new chemistry building.

SHAWANO, WIS.—Plans are being prepared by the North Wisconsin Power Company, care of J. B. Read, University of Wisconsin, University Avenue, Madison, for the erection of a transmission line from Shawano to Stiles Junction, including 40 miles of 66,000-volt primary lines and 46 miles of 13,000-volt intermediary lines. The cost is estimated at $200,000. J. S. Allen, Madison, is engineer.

CARRINGTON, N. D.—A proposal to issue $50,000 in bonds for the erection of a high-tension transmission line from Carrington to the central plant in New Rockford will be submitted to the voters. C. C. Carnahan is clerk.

WATERTOWN, S. D.—Bids will be received by the Public Utilities Commission until Jan. 12, 1922, for a complete distribution system including street and commercial wiring. The cost is estimated at $40,000. A. J. Mueller is superintendent of the electric light plant.

WHITE RIVER, S. D.—F. W. Schwartz is having plans prepared for the construction of a hydro-electric plant and dam on the White River.

BEATRICE, NEB.—The Nebraska Gas & Electric Company contemplates the construction of a new plant, to cost about $150,000.

LINCOLN, NEB.—Bids will be received by T. H. Berg, city clerk, until Jan. 4, 1922, for furnishing and erecting one 2,500-kw. turbo-generator with surface condenser and switchboard complete, to cost about $75,000, at the municipal electric light and water plant.

Southern States

HERNDON, GA.—The construction of a hydro-electric plant, to cost from $200,000 to $300,000, is under consideration. The project includes the erection of 106 miles of transmission line connecting Millen, Waynesboro, Midville, Swainsboro, Summit, Graymount, Statesboro and Garfield. W. N. Drake, Pelham, Ga., is interested.

TARPON SPRINGS, FLA.—The Southern Utilities Company is planning to increase the output of its plant from 200 kw. to 440 kw.

MOBILE, ALA. — The Mobile Electric Company has leased the power station in Chickasaw, a suburb of Mobile, and is considering improvement. The company plans to furnish electricity in this district.

NEWTON, ALA. — The Houston Power Company, Newton, is contemplating the construction of a hydro-electric power plant and dam to develop about 3,000 hp. The project also includes the erection of a 1½ mile transmission line to connect with the present system between Ozark, Newton, Hartford and Slocumb, all in Alabama, and Gracely and Chipley in Florida. The cost is estimated at $300,000. N. A. R. Killebrew is in charge. The Southern Engineering Company, Albany, Ga., is engineer.

ABBEVILLE, LA.—Bids will be received by the Mayor and Board of Aldermen of the town of Abbeville until Jan. 5, 1922, for improvements to the electric light and waterworks system, including the installation of oil engines, generators, exciters, switchboards, light and pole line equipment, etc. J. Camile Broussard is secretary. Harry A. Mentz, Magnolia, Miss., is consulting engineer.

NEW ORLEANS, LA.—Bids will be received by R. M. Murphy, Commissioner of Public Finances, City Hall, until Jan. 4, 1922, for furnishing and installing incinerator equipment of the Decarie type, including electric traveling crane and electric generating equipment complete.

RAMONA, OKLA.—The City Council is considering the installation of an electric light system, to cost about $20,000. V. V. Long & Company, 1300 Colcord Building, Oklahoma City, are engineers.

DALLAS, TEX.—Steps have been taken by property owners on Pacific Avenue for the installation of a lighting system on that thoroughfare. The cost is estimated at $30,000. Rhodes S. Baker is chairman of the Chamber of Commerce.

FORT WORTH, TEX.—The Fort Worth Power & Light Company is considering the construction of a power station to cost about $40,000.

GROESBECK, TEX.—The installation of a new electric light plant and an ice plant in Groesbeck is under consideration.

HOUSTON, TEX.—The Houston Electric Company has submitted to the City Council a proposal to spend $1,200,000 within the next two years for improvements to its railway system in return for an extension to its franchise. Luke C. Bradley is district manager.

MERTENS, TEX.—The Prairie Pipe Line Company is planning the construction of a new electrically operated pumping plant, for which a site has been acquired. The cost, including machinery, is estimated at $100,000.

Pacific and Mountain States

SEATTLE, WASH. — The Washington Coast Utilities Company, Seattle, is having surveys made of its generating plants, transmission lines, transformer and distribution stations, with a view to making changes and improvements. The company has acquired the properties of the old Wenatchee Valley Gas & Electric Company, Wenatchee.

SPOKANE, WASH.—The Great Northern Icing Company is reported to be considering the construction of an ice-manufacturing plant in Spokane, to cost about $100,000.

TACOMA, WASH.—Plans are under way for the installation of dock equipment including four 3-ton to 5-ton cranes of loft and boom type, about 4,000 ft. monorail trackage and one 2-ton electric monorail hoist, conveying equipment, loading and unloading equipment, etc. G. W. Osgood, 612 Tacoma Building, is port engineer.

REEDSPORT, ORE.—The Three Rivers Light & Power Company, recently incorporated with a capital of $50,000 by Stanley D. Chapin and others, is considering plans for furnishing electricity in Reedsport. The company proposes to acquire the distribution system of the old light plant and install two Diesel engines.

HAYWARD, CAL.—Plans and specifications are being prepared for the installation of a new electrolier system in Hayward. M. Templeton is clerk.

LATHROP, CAL.—The installation of a lighting system in the town of Lathrop is under consideration.

QUINCY, CAL.—Surveys are being made for the erection of a transmission line to connect the local electric light plant with the line of the Great Western Power Company at a point between Indian Falls and Paxton to supply electricity in Quincy. F. G. Ganser is owner of the local plant.

REDWOOD CITY, CAL.—Bids will be received by the City Trustees, until Jan. 3, 1922, for the installation of fifty-three electroliers, 9,600 lin.ft. 1¼-in. conduit and 9,600 lin.ft. 2-in. conduit cable. C. L. Dimmitt, First National Bank Building, is engineer.

ESCALANTE, UTAH.—Bonds have been authorized for the purchase of the local electric light and power plant for municipal operation.

Canada

BRANDON, MAN. — Negotiations are under way between the City Council of Brandon and the government of Manitoba for extending the provincial hydro-electric lines to Brandon. The cost of the extension of the Winnipeg-Portage line from Portage la Prairie to Brandon and necessary equipment in Brandon, Portage la Prairie and Winnipeg is estimated at $1,200,000.

MONCTON, N. B.—General contract has been awarded by the Moncton Tramway, Gas & Electric Company, Ltd., to T. E. Gilbert, 15 Ralph Street, for the construction of a power plant, to cost about $35,000.

GUELPH, ONT. — The city authorities contemplates the installation of one imperial 3,000,000-gal. electrically driven centrifugal pump and one 3,000,000-gal. electrically driven booster pump as an auxiliary to supplement the steam equipment now in use at the waterworks plant. Two 3,000,000-gal. gasoline or Diesel-driven units will also be purchased.

KINGSTON, ONT.—The City Council has decided to submit to the voters at the elections in January a by-law authorizing $12,000 in debentures for an electric police signal system in Kingston.

LONDESBORO, ONT.—The installation of an electric light and power distribution system in Hullet Township, to cost about $40,000, is under consideration. J. Fingland, Londesboro, is interested.

LONDON, ONT. — The Ontario Power Commission is considering the installation of a hydro-electric system in the towns of Tara, Port Elgin, Southampton and Paisley. The cost is estimated at $100,000. A. Beck, 169 Albert Street, is chairman.

ST. MARY'S, ONT.—Plans are under consideration for the installation of an electric light and power distribution system in Blanshard Township, to cost about $40,000. For further information address J. H. Jameson, St. Mary's.

THEDFORD, ONT.—The installation of an electric light and power distribution system in Bosanquet Township, to cost about $30,000, is under consideration. J. N. Wilson, 190 University Avenue, Toronto, is engineer.

WINDSOR, ONT.—The Grand Trunk Railway Company, London, is planning the electrification of its railway yards at Windsor. C. Forrestly, London, is division engineer.

Miscellaneous

PANAMA.—Bids will be received at the office of the General Purchasing Officer, the Panama Canal, Washington, D. C. until Dec. 29, for furnishing steel cable, fire-alarm switchboard, etc. (Circular 1463).

CHIHUAHUA, MEXICO. — The electric light and power plant and street railway system of the Chihuahua Electric Railway Company have been taken over by R. Lopez of Durango, and others. Improvements and extensions, including the installation of new machinery and the rehabilitation of the street railway lines, is under consideration. Jose Asunsolo has been appointed general manager of the company.